Product Overview

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Product Overview 1994

Welcome to the New 1994 Intel Product Overview

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PREFACE

Welcome to the new 1994 Intel *Product Overview*. It is a summary of Intel's product line intended to provide a quick reference on Intel products for designers of microcomputer systems.

Intel is the largest semiconductor company in the world. Its 25-year history has been marked by a remarkable number of scientific breakthroughs and innovations—the first microprocessor, the erasable programmable read-only memory (EPROM), and dynamic random access memory (DRAM), to name a few. In addition to microprocessors, Intel's product line covers a broad spectrum that includes flash memory, microcontrollers and embedded processors, PC enhancement products and local area networking (LAN) products.

Inside the new *Product Overview* are summaries of each of Intel's major product families supported by key features and benefits in easy-to-scan-bullets. There are also tables containing technical specifications on individual family members.

An alphanumeric index to all documents found in Intel's 1994 handbooks can be found in Appendix A. For more documentation on specific Intel products, call Intel's Literature Center at 1-800-548-4725. In addition to printed documentation, Intel offers automated technical support through the FaxBACK service and Bulletin Board System (BBS). For an automated menu and a summary of the information that can be ordered via the FaxBACK service dial 1-800-628-2283; for Intel's BBS dial 916-356-3600 and the user-friendly system will prompt you through. For answers to technical questions, please call 1-800-INTEL-4-U (United States and Canada) or 1-916-356-7368 (outside of the United States).

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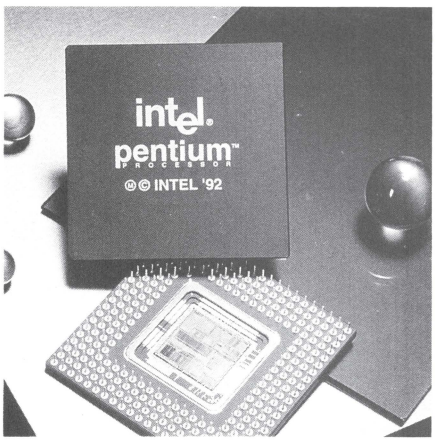
Microprocessor Products

CHAPTER 1
MICROPROCESSOR PRODUCTS

1.1 PENTIUM™ PROCESSOR FAMILY



The Pentium™ processor is Intel's latest generation of high power microprocessors for high-performance desktops and servers. This high-performance CPU runs up to five times faster than the Intel486™ DX-33 CPU, allowing sophisticated visual capabilities in advanced desktop systems. The Pentium processor is fully compatible with the entire range of Intel486 and Intel386™ microprocessors and is binary compatible with both the Intel486 DX and Intel386 DX CPUs. It also has data integrity features for mission critical applications.

The Pentium processor is fabricated using Intel's .8 micron BiCMOS process, which uses bipolar transistors for increased speed and CMOS for power and density. Previous instructions in earlier Intel CPUs are hard-wired in the Pentium processor for increased performance and full compatibility with previous Intel architecture microprocessors.

Features

- 112 million instructions per second (MIPS)
- SPECint92 integer performance of 67.4 and SPECfp92 performance of 63.6 at 66 MHz
- Binary compatible with over 50,000 applications based on operating systems such as Windows*, DOS, OS/2* and UNIX*
- 66-MHz and 60-MHz clock CPU and bus speed
- Superscalar architecture
- Enhanced floating-point unit
- 64-bit data bus
- Branch prediction
- Separate code and data caches with MESI protocol
- Performance monitoring and execution tracing
- High-reliability error detection

Benefits

- Superior speed and performance
- Advanced graphics and audio capabilities
- High integration for increased board space
- Binary compatible with all Intel486 and Intel386 CPU application software

Applications

- High-performance clients and servers
- Complex financial analysis
- Computer-aided design
- Computer-aided engineering
- Full-motion video
- Voice recognition
- Imaging

1.2 SL ENHANCED Intel486™ MICROPROCESSOR FAMILY

The energy-efficient SL technology of the Intel486 SL microprocessor family enhances the Intel486 CPU line, enabling the development of superior, energy-efficient systems. Using SL enhanced Intel486 CPUs, OEMs can now develop high-performance, energy-efficient systems that meet or exceed the EPA's Energy Star guidelines without sacrificing performance or compatibility. The key lies in designing systems with intelligent power management built into the hardware. SL enhanced Intel486 CPUs make possible a new class of desktop computers and notebook systems including high-performance color notebooks and low-cost, entry-level notebooks, all with uncompromised battery life. Many Intel486 DX2 CPU-based systems are upgradable to Intel OverDrive™ processors based on Intel's Pentium processor technology.

Features

- SL technology for fully compatible, intelligent power management
- 3.3V or 5V operation with 3.3V delivering 50 percent power savings
- 208-lead SQFP package and 168-lead PGA package
- Complete 32-bit architecture
- Binary compatible with an entire library of software based on operating systems such as MS-DOS*, Windows, Windows NT*, OS/2, UNIX, iRMX® Real-Time Kernel operating system, NeXTstep* 486 and Solaris*
- Common core instructions execute in a single internal clock cycle
- On-chip 8-Kbyte unified code and data cache
- On-chip floating-point unit compatible with Intel387™ math coprocessor
- Burst data bus capable of 106-Mbyte/sec transfer rate at 33-MHz bus clock (Intel486 DX2 and Intel486 SX CPUs); 160-Mbyte/sec transfer rate at 50-MHz bus clock (Intel486 DX CPU)
- Upgradable with Intel OverDrive processor

Benefits

- Superior energy efficiency without compromising performance or compatibility
- Configuration flexibility to address current and future needs

Applications

- High-performance, affordable notebook computers
- Desktop personal computers
- Business workstations

Table 1-1. SL Enhanced Intel486™ Microprocessor Benchmark Results

Product Name	SPECint92	PC Labs 7.0	iCOMP™ Index
Intel486™ DX2 66-MHz CPU	32.2	17415	297
Intel486 DX2 50-MHz CPU	25.7	13165	231
Intel486 DX 50-MHz CPU	27.9	14139	249
Intel486 DX 33-MHz CPU	18.6	9177	166
Intel486 SX 33-MHz CPU	18.6	9026	136
Intel486 SX 25-MHz CPU	14.2	6800	100

1.3 INTEL iCOMP™ INDEX

The Intel iCOMP™ (Intel COmparative Microprocessor Performance) index was created to give PC buyers information on the relative performance of Intel's microprocessors. An Intel microprocessor's iCOMP rating index is based on the technical categories that encompass four separate aspects of 16- and 32-bit CPU performance—integer, floating-point, graphics and video performance. Each category is weighted based on the estimated percentage of time each enters into the processing picture. The higher the iCOMP index, the higher the relative performance of the microprocessor.

Figure 1-1 is the iCOMP index rating chart. It can be used to compare the overall performance of a typical application workload of Intel's 32-bit microprocessors. The essence of the index is relative performance. Since the 25-MHz Intel486 SX microprocessor is currently the entry-level member of the Intel486 CPU family, it was selected as the base CPU for the index and arbitrarily assigned an iCOMP rating of 100. Each of the other CPU ratings is relative to the performance of the 25-MHz Intel486 SX microprocessor.

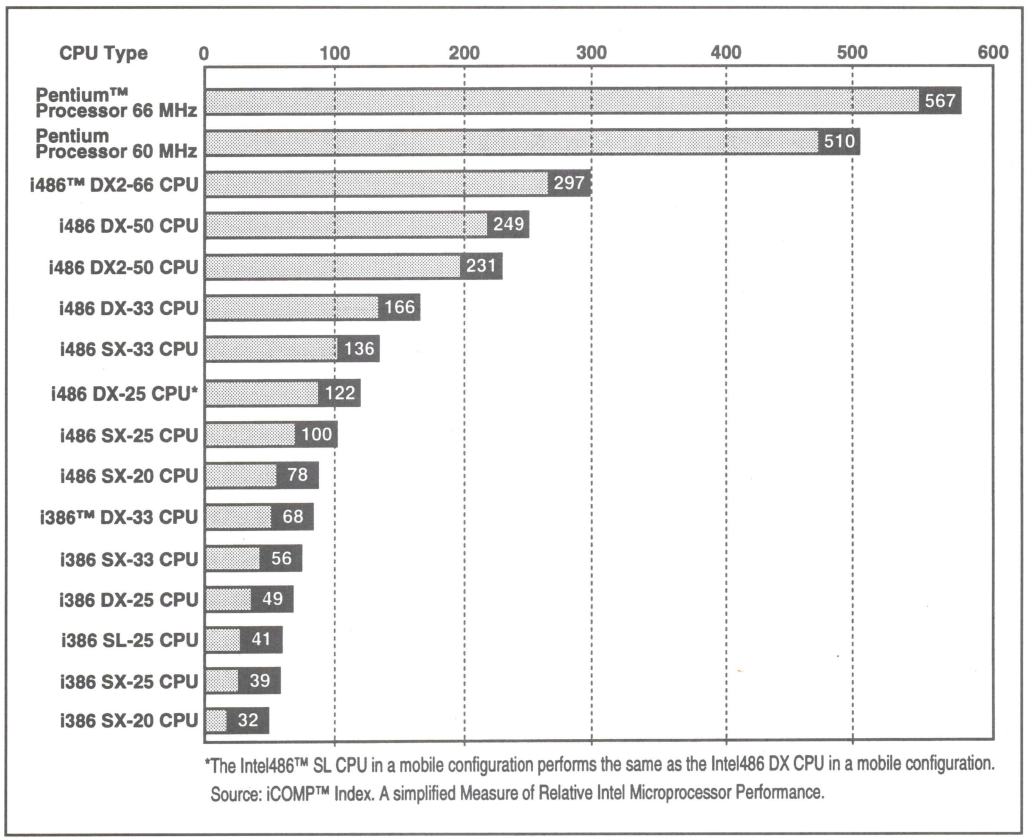


Figure 1-1. iCOMP™ Index Rating Chart

Table 1-2. Intel Microprocessor Component Specifications

Feature	Intel386™ SX CPU	Intel386 DX CPU	Intel486™ SX CPU	Intel486 SX Low Power CPU	SLE Intel486 SX CPU	Intel486 DX CPU	SLE Intel486 DX CPU	Intel486 DX2 CPU	SLE Intel486 DX2 CPU	Pentium™ Processor
Package pins	100	132	168/196	196	168/196	168	168	168	168, 208	273
Package type	PQFP	PGA	PGA, PQFP	PQFP	PGA, PQFP	PGA	PGA	PGA	PGA/SQFP	PGA
Power supply	5V	5V	5V	3V	5V	5V	5V	5V	5V	5V
Process technology	CHMOS	CHMOS	CHMOS	CHMOS	CHMOS	CHMOS	CHMOS	CHMOS	CHMOS	BiCMOS
iCOMP™ index rating (highest MHz)	39	68	136	136	136	249	166	297	297	567
Bus interface (bits)										
Data address	16	32	32	32	32	32	32	32	32	64
Address	24	32	32	32	32	32	32	32	32	32
Internal data path	32	32	32	32	32	32	32	32	32	32
Clock frequency (MHz)	16,20, 25,33	16,20, 25,33	16,20, 25,33	16,20, 25,33	16,20, 25,33	25,33, 50	25,33, 50	50,66	50,66	60, 66
Math coprocessor	Yes	Yes	Yes	Yes	Yes	Integrated FPU on chip	Integrated FPU on chip	Integrated FPU on chip	Integrated FPU on chip	Enhanced integrated FPU on chip
OverDrive™ processor upgradable	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 1-2. Intel Microprocessor Component Specifications (Contd.)

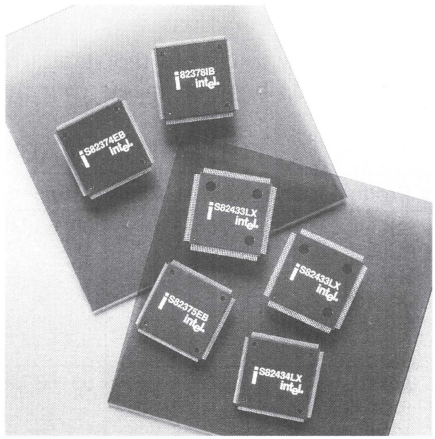
Feature	Intel386™ SX CPU	Intel386 DX CPU	Intel486™ SX CPU	Intel486 SX Low Power CPU	SLE Intel486 SX CPU	Intel486 DX CPU	SLE Intel486 DX CPU	Intel486 DX2 CPU	SLE Intel486 DX2 CPU	Pentium™ Processor
Internal cache	N/A	N/A	On chip	On chip	On chip	On chip	On chip	On chip	On chip	Separate instruction and data caches on chip
External cache	N/A	N/A	25,33 MHz 82485	25,33 MHz 82485	25,33 MHz 82485	25,33 MHz 82485	50 MHz 82495DX/ 82490DX	82495DX/ 82490DX	82495DX/ 82490DX	82496/ 82491
High-level languages	A WIDE VARIETY OF THIRD-PARTY SOFTWARE IS AVAILABLE									
Operating systems										
ISA	THIRD-PARTY CHIP SETS AVAILABLE									N/A
EISA	N/A	82350/DT	82350/DT	82350/DT	82350/DT	82350/DT	82350/DT	82350/DT	82350/DT	N/A
MCA	THIRD-PARTY CHIP SETS AVAILABLE									N/A
PCI	N/A	N/A	82420 PCIset	82420 PCIset	82420 PCIset	82420 PCIset	82420 PCIset	82420 PCIset	82420 PCIset	82430 PCIset
Disk controllers	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA	82078/ 82077SL/ 82091AA
Keyboard controllers	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42	UPI-42/ C42

2

PCIsets and I/O Products

CHAPTER 2
PCIsets AND I/O PRODUCTS

2.1 82430 PCIset CACHE/MEMORY SUBSYSTEM FAMILY



Using new design techniques, the 82430 PCIset cache/memory subsystem brings concurrency to Pentium processor systems. Concurrency means that the Pentium processor is not forced to wait for slower memory or peripherals to respond before moving on to its next task. Conventional chip sets do not provide the write and prefetch buffers that are in the 82430 PCIset which help remove these performance bottlenecks from the system. The 82430 PCIset also supports PCI-to-PCI or PCI-to-memory transactions out of either the level one (internal) or level two (external) cache memory concurrent with CPU operation.

The high-performance cache supported by the 82430 PCIset allows for zero wait-state burst transactions at 66 MHz using burst SRAM devices. This technique allows data to be sent or retrieved from the cache at the fastest possible burst rate supported by the Pentium processor.

In the 82430 PCIset, a single device integrates all of the following functions: PCI control, cache control for 256 Kbyte or 512 Kbyte level two cache, memory control for 2 Mbyte to 192 Mbyte main memory, and tag RAM required for the cache.

This is called the PCI, Cache, Memory Controller (PCMC), which is the hub of the 82430 PCIset design. To incorporate the ability to transfer graphics data at the same rate as the Pentium processor, the 82430 PCIset includes the Local Bus Accelerator (LBX) component. This component also integrates the buffering and data paths that speed data throughout the 82430-based system.

The 82430 PCIset supports both EISA or ISA conventional expansion I/O buses. These are supported via components that are specific to each bus. ISA control is integrated into a single chip, the System I/O (SIO), while EISA is implemented in a two-chip solution: the PCI to EISA Bridge (PCEB) and the EISA System Component (ESC).

Features

- High-performance graphics
- Full PCI implementation
- High integration
- Optional ISA/EISA bus
- Write buffers
- Designed for Pentium processor architecture

Benefits

- Cost-effective integration of the latest graphic technology
- Affordable peripherals with local bus performance
- Optimized total system performance
- Ability to build small PCs with many integrated functions
- Flexibility to choose the standard expansion bus that meets your needs
- Reduced system wait-states
- Will meet future system performance requirements

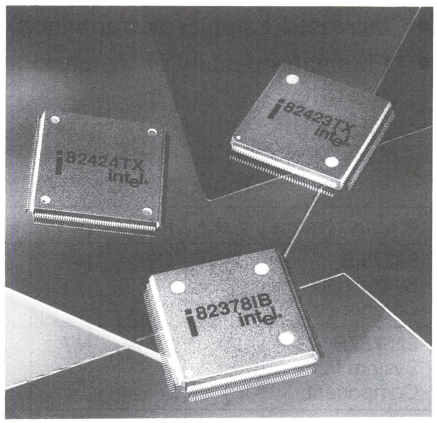
Applications

- Pentium processor-based desktop systems and servers

Table 2-1. 82430 PCIset Components Product Information

Product Name	#Pin	Pkg.	Speed	Power	Key Features
82434LX PCI/Cache/ Memory Controller (PCMC)	208	QFP	60, 66 MHz	5V	Supports 64-bit Pentium™ processor at 60 MHz and 66 MHz Pipelined addressing High-performance CPU/PCI/memory interface Fully synchronous 33-MHz PCI bus interface Writethrough or writeback mode
82433LX Local Bus Accelerator (LBX)	160	QFP	60, 66 MHz	5V	Supports the full 64-bit Pentium processor data bus at 66 MHz Provides a 64-bit interface to DRAM memory and 32-bit interface to PCI Five integrated write posting and read prefetch buffers
82374EB EISA System Component (ESC)	208	QFP	60, 66 MHz	5V	Integrates EISA-compatible bus controller Supports eight EISA slots Provides enhanced DMA controller Provides high-performance arbitration
82375EB PCI-EISA Bridge (PCEB)	208	QFP	60, 66 MHz	5V	Provides bridge between the PCI bus and EISA bus 100% PCI and EISA compatible Data buffers improve performance Data buffer management ensures data coherency Burst transfers on both the PCI and EISA buses

2.2 82420 PCIset FAMILY



The Intel 82420 PCIset contains three components: the 82424 Cache DRAM Controller (CDC), the 82423 Data Path Unit (DPU), and the 82378 System I/O (SIO). The CDC and DPU provide the core system architecture while the SIO is a PCI master/slave agent which bridges the core architecture to the ISA standard expansion bus.

The 82424 Cache DRAM controller (CDC) is a single-chip bridge from the CPU to the PCI bus. It provides the integrated functionality of a second-level cache controller, a DRAM controller and PCI bus controller. It also features an optimized memory subsystem. The CDC is a dual-ported device with one port as the host port and the other port as the PCI port. The 82424 provides 25 and 33 MHz support. The 82424ZX-50 will support 50 MHz.

The 82423 Data Path Unit (DPU) integrates the host data, memory data, PCI data interface, DPU control/parity and four deep-posted write buffers. Buffers allow the CPU write cycles to be executed as zero wait states. With glue and buffers integrated directly into the DPU, the Intel 82420 PCIset reduces board space requirements.

The 82378 System I/O (SIO) is a dual-ported device that acts as a bridge between the PCI and standard I/O bus. This component is reusable within the Intel 82420 PCIset and future Intel PCIsets. The SIO integrates the functionality of the ISA controller, PCI controller, fast 32-bit DMA controller and standard system I/O functions. The 82378ZB supports six PCI masters, edge/level selectable interrupts, four dedicated PCI interrupts and provides complete support for SL Enhanced Intel486 CPUs.

Features

- PCI local bus
- Supports upgrade processor in write-back cache mode
- Reusable across multiple platforms
- Supports A, B and F types DMA
- Integrates write buffers
- Enables concurrent linefill during copyback cycles

Benefits

- Enables high-performance graphics and I/O
- Reusable I/O across multiple CPU generations
- Enhanced performance
- Reduces design complexity
- Enhances performance of ISA systems
- Isolates the CPU bus from the PCI bus

- Provides zero wait-state write performance
- Increased graphics performance
- Eliminates penalty of writeback algorithm

Applications

- Intel486 processor-based desktop systems and servers.

Table 2-2. 82420 PCIset Components Product Information

Product Name	# Pin	Pkg.	Speed	Power	Key Features
82378IB System I/O Component	208	QFP	N/A	5V	PCI to EISA bridge Enhanced DMA: Types A, B, & F
82378ZB System I/O Component	208	QFP	N/A	5V	82378IB features plus edge/level interrupts, scatter gather, support for Intel486™ SL Enhanced CPUs
82423TX Data Path Unit	160	QFP	25, 33	5V	Burst read of memory concurrent operation of host and PCI buses Posted write buffers
82423ZX Data Path Unit	160	QFP	25, 33, 50	5V	82423TX features plus 50 MHz support
82424TX Cache DRAM Controller	208	QFP	25, 33	5V	Supports L2 WT or WB, 64K – 512K cache, posted write buffers
82424ZX Cache DRAM Controller	208	QFP	25, 33	5V	82424TX features, L1 WB mode
82424ZX-50 Cache DRAM Controller	208	QFP	25, 33, 50	5V	82424ZX features plus 50 MHz support

2.3 82078 FLOPPY DISK CONTROLLER FAMILY

The 82078 is based on the Intel 82077AA/SL, therefore it is fully backward compatible with the industry standard. It includes the features of the 82077AA/SL plus 3.3V support and 2 Mbps data rates, all in a smaller package. The device is fully compatible with all chip sets and CPUs in the industry today, enabling fast design and quick time to market. In addition, the 82078 features save and restore commands that simplify software design.

The 16-byte FIFO and high-speed host interface allow a greater level of bus utilization in multi-master environments like EISA, Micro Channel* and PCI. The FIFO bursts data across the bus with less handshaking, and the high-speed interface ensures that data transfers take place without slowing the bus down as other solutions do—all without compromising compatibility.

Desktop and server designs can take advantage of the 82078 44-lead packages available in two versions, one with and one without 4-Mbyte drive support. The 82078-5, a 44-lead device for desktops and notebooks does not support 4-Mbyte drives.

The device incorporates an analog phase-locked loop for superior disk jitter tolerance. A novel second PLL eliminates the trimming circuitry normally associated with analog PLLs. This PLL compensates for frequency, voltage, temperature and process variations. The result is high analog performance levels and the lowest soft error rates without external trim components.

Features

- Nearly one third the size of 68-lead PLCC
- Small footprint and low-height packages
- Superior disk jitter tolerance
- High analog performance level; low soft error rate
- 3.3V support and enhanced auto power management
- 2 Mbps data rate for new tape drives
- Media ID pin
- Identifies diskette density and format
- Full 82077AA/SL software compatibility

Benefits

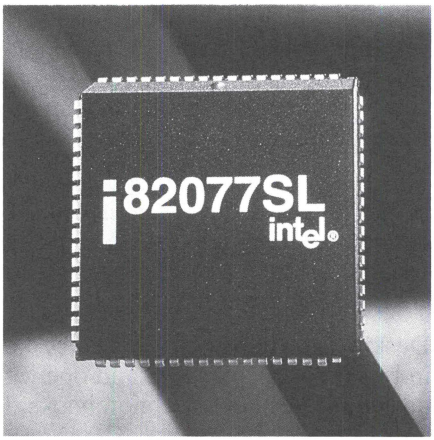
- Saves board space
- Longer battery life for 3.3V notebooks
- Faster data transfer for new tape drives
- No software changes
- Helps reduce overall system cost
- Full compatibility with all chip sets and CPUs enables fast design and quick time to market

Applications

- Desktop personal computers

2.4 82077SL SINGLE-CHIP FLOPPY DISK CONTROLLER

The 82077SL is a superset of the industry-standard 82077AA Floppy Disk Controller. It contains programmable power management features while integrating all of the logic required for floppy disk control. The power management features are transparent to application software. The 82077SL is fully compatible with Intel SL architecture and IBM PC AT* and PS/2* chip sets. The 82077SL is fabricated with Intel's advanced CHMOS III technology and is available in a 68-lead plastic leaded chip carrier (PLCC) package.



Features

- Automatically enters power-down mode when idle
- Internal oscillators can be powered down as needed
- Can read internal registers while in power-down mode
- Perpendicular recording mode
- Integrated high current disk drive and host data buffers
- Integrated 16-byte FIFO

Benefits

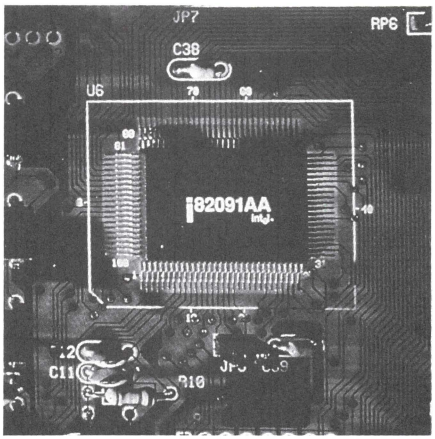
- Conserves power/software transparency
- Allows design of higher density 4-Mbyte drives for notebook and laptop PCs
- Saves valuable board space
- FIFO provides bus latency protection required in multi-master systems

Applications

- Floppy disk control
- Tape drive back-up

2.5 82091AA ADVANCED INTEGRATED PERIPHERAL (AIP)

Intel's Advanced Integrated Peripheral integrates the Intel 82078 Floppy Disk Controller Core, two 16550 serial ports, one multi-functional parallel port (ECP, EPP, Centronics), and interface logic for an IDE connector and a game port. Each function supports direct and auto power-down modes.



The 82078 Floppy Disk Controller supports a 4-Mbyte standard, up to four drives, and a 2 Mbps data rate for new tape drives. It is fully compatible with the Intel 82077 and 82078.

Both serial ports are 16550-compatible and include 16-byte FIFOs. They deliver improved system performance and reliable operation for new high-speed modems.

Features

- 82078 Floppy Disk Controller Core
- Two 16550 serial ports with 16-byte FIFOs
- One multi-functional parallel port (ECP, EPP, Centronics)
- 5V/3.3V supply operation with 5V-tolerant peripheral interface
- Dual IDE interface
- Power management
- 24 mA system interface
- 2 Mbps data rates

Benefits

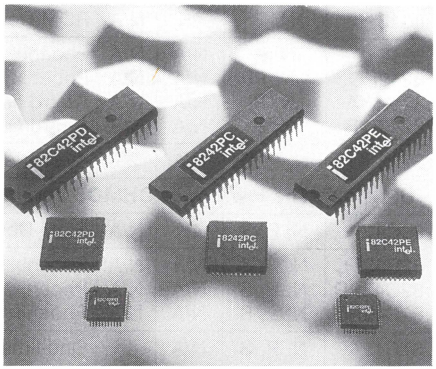
- Compatible with industry-standard Intel 82077 and 82078
- Provides higher system performance and reliable operation with high-speed serial peripherals
- Flexibility to operate at 3.3V using affordable 5V peripherals
- Fully complies with IEEE 1284 standard
- Supports Microsoft's new bi-directional ECP standard
- Supports high-speed printing and future implementation of scanners and CD-ROMs
- Enables control of two IDE devices
- Minimizes power consumption to enable implementation of energy-efficient PCs. Automatic power-down makes power management easy
- Direct ISA bus interface for add-in card implementation
- Supports new tape drives

Table 2-3. Standard Intel PC Peripherals Product Information

Product Name	Pins	FDC Density	FDC Speed (bps)	Power Management	Volts	Serial Port	Parallel Port	IDE Interface	Applications
N, 82077AA	68	4 Mbyte	1 Mbps	N	5V	N/A	N/A	N/A	Industry-standard FDC
N, 82077AA-1	68	4 Mbyte	1 Mbps	N	5V	N/A	N/A	N/A	Industry-standard FDC
N, 82077AA-5	68	2 Mbyte	500 kps	N	5V	N/A	N/A	N/A	Industry-standard FDC
N, 82077SL	68	4 Mbyte	1 Mbps	Y	5V	N/A	N/A	N/A	Portables
N, 82077SL-1	68	4 Mbyte	1 Mbps	Y	5V	N/A	N/A	N/A	Portables
N, 82077SL-5	68	2 Mbyte	500 kbps	Y	5V	N/A	N/A	N/A	Portables
S,82078SL	64	4 Mbyte	1 Mbps	Y	3V, 5V or 3V/5V Split	N/A	N/A	N/A	Premium platforms
S,82078-1	64	4 Mbyte	2 Mbps	Y	5V	N/A	N/A	N/A	New tape drive support
S,82078	44	4 Mbyte	1 Mbps	Y	5V	N/A	N/A	N/A	Volume desktops
S,82078-5	44	2 Mbyte	500 kbps	Y	5V	N/A	N/A	N/A	Cost-sensitive platforms
S,82078-3	44	4 Mbyte	1 Mbps	Y	3V	N/A	N/A	N/A	3.3V platforms
S,82091AA	100	4 Mbyte	1 Mbps	Y	3V, 5V or 3V/5V Split	2 × 16550	ECP, EPP, Cent.	Yes	EED, notebook, desktop, and add-in card

2.6 UPI-42/KEYBOARD CONTROLLER FAMILY

Intel's UPI-42/keyboard controller family is the industry standard for providing keyboard control in the PC. The UPI-42 family line provides a wide variety of product offerings for complete design flexibility. The UPI-42 products are available in OTP (one-time programmable), ROM and pre-programmed keyboard controller versions. This mix of products provides full programming flexbility, low cost, and off-the-shelf KBC solutions. Low-powered UPI-C42 and low-voltage UPI-L42 versions are also available. The UPI-C42 doubles the user programmable memory size, adds auto A20 gate support, includes Standby[1] and suspend power-down modes, and is available in a space-saving 44-lead QFP package. With the UPI-42 family, you can select the microcontroller that exactly meets your keyboard controller requirements.



1. Standby feature not supported on current (B-1) stepping.

Features

- On-chip OTP memory
- Pre-programmed KBC versions
- Fully compatible CHMOS and 3.3V versions
- Compact packaging
- Security bit code protection

Benefits

- Select the microcontroller that exactly meets your keyboard controller requirements
- Flexibility in code development
- Easy upgrade path for low-power and low-voltage designs
- Saves board space
- Helps prevent firmware piracy

Applications

- Proprietary keyboard controller applications
- Industry-standard desktop keyboard control
- Energy-efficient desktop keyboard control
- Notebook keyboard and scan code control

Table 2-4. UPI-42 Family Product Information

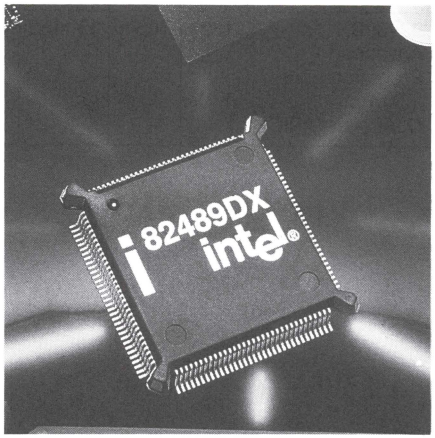
Product Name	Package	ROM	OTP	Comments
UPI-42—The Industry Standard for Desktop Keyboard Control				
8042	N, P	2K	N/A	ROM Device
8242	N, P	N/A	N/A	Phoenix firmware version 2.5
8242PC	N, P	N/A	N/A	Phoenix MultiKey/42 firmware, PS/2*-style mouse support
8242WA	N, P	N/A	N/A	Award firmware version 3.57
8242WB	N, P	N/A	N/A	Award firmware version 4.14, PS/2-style mouse support
8742	N, P, D	N/A	2K	Available as OTP (N, P) or EPROM (D)
UPI-C42—The low power CHMOS version of the UPI-42				
80C42	N, P, S	4K	N/A	ROM Device
82C42PC	N, P, S	N/A	N/A	Phoenix MultiKey/42 firmware, PS/2-style mouse support
82C42PD	N, P, S	N/A	N/A	Phoenix MultiKey/42L firmware, KBC and SCC for portable applications
82C42PE	N, P, S	N/A	N/A	Phoenix MultiKey/42G firmware, energy-efficient KBC solution
87C42	N, P, S	N/A	4K	One-time programmable version
UPI-L42—The low voltage 3.3V version of the UPI-C42				
80L42	N, P, S	4K	N/A	ROM device
82L42PC	N, P, S	N/A	N/A	Phoenix MultiKey/42 firmware, PS/2-style mouse support
82L42PD	N, P, S	N/A	N/A	Phoenix MultiKey/42L firmware, KBC and SCC for portable applications
87L42	N, P, S	N/A	4K	One-time programmable version

NOTE:

N = 44-lead PLCC
P = 40-lead PDIP
S = 44-lead QFP
D = 40-lead CERDIP
KBC = Keyboard Control
SCC = Scan Code Control

*Other brands and names are the property of their respective owners.

2.7 82489DX ADVANCED PROGRAMMABLE INTERRUPT CONTROLLER



A multiprocessor system with a shared system memory bus needs an interrupt controller like the 82489DX. With its own independent communication bus, the 82489DX places no overhead on system performance and scalability, thus allowing greater bus utilization.

Its unique method of dynamic interrupt distribution allows load balancing, enabling all processors to operate at peak performance. This includes routing of the interrupt to the lowest-priority processor. The device also provides inter-processor interrupts, allowing any processor to interrupt any processor or set of processors.

The 82489DX works with leading 32-bit operating systems such as Microsoft Windows NT, IBM OS/2, SCO UNIX, Solaris, and UNIX SVR4*.

Features

- Dynamic interrupt distribution
- Maintains its own communications bus
- Operates at 50 or 33 MHz

Benefits

- Enables load balancing in multi-processing systems—allowing all processors to operate at peak performance
- Reduces traffic on the memory bus
- Places no demands on system performance and scalability
- Significantly faster than the 8259A
- Low interrupt latency

Applications

- Multi-threaded operating systems (both uni- and multiprocessor)
- Interrupt distribution in multiprocessor operating systems
- Symmetric I/O for multiprocessor operating systems
- Efficient task priority management
- Add-on intelligent I/O systems

Table 2-5. 82489DX Product Information

Product Name	# Pin	Pkg.	Speed	Process	Power	Power Consumption	Key Features
82489DX Advanced Programmable Interrupt Controller (APIC)	132	PQFP	33 MHz	CHMOS	5V	1 watt	Inter-processor communication Dynamic interrupt distribution Task priority mechanism

2.8 82355 BUS MASTER INTERFACE CONTROLLER

For add-in board support, Intel offers the 82355 EISA Bus Master Interface Controller (BMIC). It provides a simple yet powerful and flexible interface between the local functions on the bus master board and the EISA bus master protocol. With the help of external buffer devices, the BMIC provides all of the control signals, address lines, and data lines necessary for an EISA bus master to interface to the EISA bus.

The 82355 BMIC greatly simplifies the design of 32-bit EISA bus masters. With the BMIC, an expansion board can be implemented with simple logic similar to that used in traditional ISA DMA designs; however, the BMIC also allows the designer to take full advantage of the advanced features of EISA bus masters. These include burst mode for data transfer rates up to 33 Mbyte/sec, EISA automatic configuration, and 32-bit address bus, which covers the entire 4 Gbyte EISA address space.

The BMIC has two data transfer channels. Each has two registers that allow the local processor to begin programming the next transfer on the channel while the current transfer is being executed.

To maximize system throughput, the 82355 BMIC incorporates three fully concurrent ports: EISA port, buffer port, and local CPU port. The EISA port incorporates two 24-byte FIFOs and implements the full EISA protocol. The local buffer port is optimized for high-speed static RAM buffers. The CPU port supports a generic slave interface and allows the local microcontroller (typically the 80186 or 8051) to initiate and terminate transfers. All three ports may operate concurrently, thus maximizing overall system performance.

Features

- Three fully concurrent EISA, buffer and local CPU ports
- Supports 16 and 32-bit buses
- Allows data transfer rates up to 33 Mbyte/sec
- Supports 32-bit EISA addressability (4 Gbyte)
- Two independent data transfer channels with 24-byte FIFOs
- Supports automatic handling of complete EISA bus master protocol

Benefits

- Superior system throughput and performance
- Maximum EISA addressability for maximum flexibility, functionality and performance
- Ability to perform simultaneous operations maximizes system performance
- Easy to implement expansion boards

Applications

- EISA bus master expansion board designs
- Disk controller interface (SCSI, ESDI, disk array)
- LAN adapter cards
- Graphics cards
- Host adapter boards

Table 2-6. 82355 Product Information

Product Name	# Pin	Pkg.	Process	Power	Power Consumption	Key Features
NG82355 EISA Bus Master Interface Controller (BMIC)	132	QFP	CHMOS	5V	1.8 watts	High-integration bus master providing a simple yet powerful and flexible interface between the functions on the expansion board and EISA bus

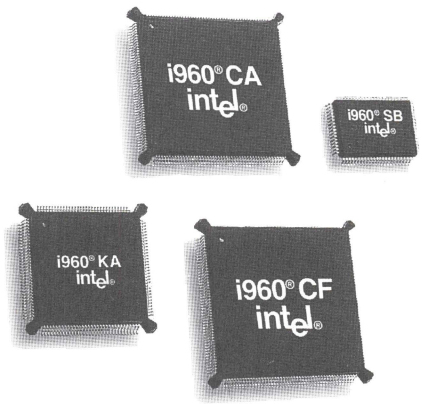
3

i960® Microprocessors

CHAPTER 3
i960® MICROPROCESSORS

3.1 i960 MICROPROCESSORS

The i960® microprocessor, the world's first superscalar 32-bit microprocessor developed for embedded applications, offers high-performance computing with high-speed instruction execution. Intel's RISC microprocessor architecture is the industry leader in shipments.[1] Intel offers a single architectural solution and growth path for every level of embedded applications. The product architecture offers versions with floating-point units, on-chip cache, aligned/unaligned big and little endian-support, superscalar, and 16-/32-bit buses. Thus, regardless of your application, there is an i960 microprocessor that meets your performance requirements.



1. *RISC Management* Newsletter, January, 1994

Features

- Large register sets
- Load/store architecture
- Instruction cache
- Floating-point unit
- Superscalar performance for 80960CA/CF
- DMA controller for 80960CA/CF
- Pipelined burst bus

Benefits

- Efficient optimization of execution speed
- Reduced memory access enhances performance
- No additional bus overhead associated with floating-point calculations
- Allows sustained execution of multiple instructions per clock cycle
- Manages 4-channel DMA transfer concurrent with program execution
- Increases performance of low-cost memory systems and provides maximum memory bandwidth
- A single architectural solution and growth path for every level of embedded applications

Applications

- Networking: bridges, routers
- Printers
- X-terminal workstations
- Mass storage
- Navigation
- Military/avionics

Table 3-1. i960® Microprocessor Versions and Specifications

Product Name	Speed (MHz)	Instruction Cache	FPU	Interrupt Controller	On-Chip MMU	Pkg	Key Features
80960CF	16, 25, 33	4 Kbytes	No	8 direct inputs	No	A, KU	32-bit RISC superscalar CPU with on-chip DMA, programmable bus size, and 1 Kbyte data cache
80960CA	16, 25, 33	1024 Bytes	No	8 direct inputs	No	A, KU	32-bit RISC superscalar CPU with on-chip DMA and programmable bus size
80960KA	10, 16, 20, 25	512 Bytes	No	4 direct inputs	No	A, NG	32-bit RISC CPU with multiplexed bus
80960KB	10, 16, 20, 25	512 Bytes	Yes	4 direct inputs	No	A, NG	32-bit RISC CPU with mulitplexed bus and IEEE floating point
80960SA	10, 16, 20	512 Bytes	No	4 direct inputs	No	N, S	Low-cost 32-bit RISC CPU with multiplexed 16-bit bus
80960SB	10, 16	512 Bytes	Yes	4 direct inputs	No	N, S	Low-cost 32-bit RISC CPU with multiplexed 16-bit bus and IEEE floating point
80960MC	16, 20, 25	512 Bytes	Yes	4 direct inputs	Yes	G, Q	32-bit RISC military fault-tolerant CPU with memory management unit
80960XA	16, 20, 25	512 Bytes	Yes	4 direct inputs	Yes	G, Q	32-bit RISC military fault-tolerant CPU with memory management unit, object-oriented addressing, and JIAWG-standard ISA
80960MM	25	2 Kbytes	Yes	8 direct inputs	Yes	MG	32-bit RISC superscalar military fault-tolerant CPU with high bandwidth back-side bus
80960MX	25	2 Kbytes	Yes	8 direct inputs	Yes	MG	32-bit RISC superscalar military fault-tolerant CPU with high bandwidth back-side bus, object-oriented addressing, and JIAWG-standard ISA

PACKAGES: A = 168L PGA for i960® CA and i960 CF processors
A = 132L PGA for i960 KA/KB processor, no 10 MHz
KU = 196L PQFP for i960 CA and i960 CF processors, no 33 MHz
NG = 132L PQFP for i960 KA/KB processor
MG = 348L PGA for i960 MM/MX processor
G = 132L CPGA for i960 MC processor
Q = 164L CQFP for i960 MC processor
N = 84L PLCC for i960 SA/SB processor
S = 80L QFP (EIAJ) for i960 SA processor, no 20 MHz; for i960 SB processor, no 16 MHz

3.2 i960 MICROPROCESSOR DEVELOPMENT TOOLS

The Solutions960® program is the industry's most complete development tools and support program with more than 65 independent hardware and software vendors supporting over a dozen different hosts. The program offers more than 160 products and services ranging from in-circuit emulators to operating systems for developing products using the i960 architecture. Intel also offers field application engineering along with technical software information, a regular users' publication, remote diagnostic software and a troubleshooting guide. To assure full satisfaction, Intel offers a 30-day, money-back guarantee on all its development tools.

For the most complete and up-to-date listings of i960 processor tools, refer to the *i960® Microprocessor Family Line Card*, Order No. 272219 and the *Solutions960® Catalog*, Order No. 270791.

Features

- Profile-driven compiler
- Microsoft Windows-based debugger
- Supports multiple hosts
- Field application engineering
- Technical software information
- Remote diagnostic software

Benefits

- Wide range of tools
- Increased run-time performance
- Enhanced debugging capability
- Maximizes customer flexibility

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4

Embedded Processors and Controllers

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CHAPTER 4
EMBEDDED PROCESSORS AND CONTROLLERS

4.1 Intel386™ MICROPROCESSOR FAMILY

The Intel386 microprocessors are entry-level 32-bit CPUs designed for single-user applications and operating systems. These processors are object code-compatible with all 8086 architecture members (8086, 8088, 80186, 80188 and 80286) for full backwards compatibility with the world's largest software installed base.

The Intel386 DX microprocessor has full 32-bit data and address buses. While the Intel386 SX microprocessor has a 16-bit data bus and a 24-bit address bus, the Intel386 SX microprocessor retains the 32-bit internal architecture of the Intel386 microprocessors.

Each processor addresses up to 4 gigabytes of physical memory and 64 terabytes of virtual memory. The integrated memory management and protection architecture includes address translation registers, multi-tasking hardware and a protection mechanism to support operating systems. Instruction pipelining and on-chip address translation ensure short average instruction execution times and maximum system throughput. The Intel386 microprocessors run on the following industry operating systems: MS-DOS, Windows, OS/2, and UNIX.

Features

- Flexible 32-bit microprocessor
  - 8-, 16-, 32-bit data types
  - 8 general-purpose 32-bit registers
- Large address space
  - 4-gigabyte physical
  - 64-terabyte virtual
  - 4-gigabyte maximum segment size
- Integrated memory management unit
  - Virtual memory support
  - Optional on-chip paging
  - 4 levels of protection
  - Fully compatible with 80286
- Object code-compatible with all 8086 microprocessors
- Virtual 8086 mode allows running of 8086 software in a protected and paged system
- Hardware debugging support
- Numeric support via Intel387 math coprocessor
- Complete system development support

4.2 Intel386 EMBEDDED PROCESSOR FAMILY

The Intel386 microprocessors are entry-level 32-bit CPUs designed for single-user embedded applications and operating systems. These processors are object code-compatible with all 8086 architecture members (8086, 8088, 80186, 80188, and 80286) for full backwards compatibility with the world's largest software installed base.

The Intel386 DX microprocessor has full 32-bit data and address buses. The Intel386 SX and the new Static Intel386 SX microprocessors have a 16-bit external data bus and a 24-bit address bus, retaining the 32-bit internal architecture. The new Intel386 CX and EX microprocessors have a 26-bit address bus and a 16-bit external data bus. The Static Intel386 SX microprocessor has the ability for clock stopping at any time.

The new Intel386 CX and Intel386 EX microprocessors are optimized for embedded applications. Both have a static core design for low power and low voltage. In addition, the Intel386 CX and EX processors have System Management Mode for transparent system control such as power management. The Intel386 EX processor includes many on-chip integrated peripheral functions.

For all Intel386 microprocessors, the integrated memory management and protection architecture includes address translation registers, multi-tasking hardware and a protection mechanism to support operation systems. Instruction pipelining and on-chip address translation ensure short average instruction execution times and maximum system throughput.

The Intel386 microprocessor family is supported by a large selection of high-quality and easy-to-use development tools from third-party vendors. Industry-standard operating systems including MS-DOS*, Windows*, OS/2, and UNIX, as well as other real-time operating systems are supported on the Intel386 microprocessors. A royalty-free real-time operating system is included with each Intel386 CX and EX microprocessor.

Features

DX/SX/Static SX:

- Flexible 32-bit microprocessor
  - 8-, 16-, 34-bit data types
  - 8 general-purpose 32-bit registers
- Large Address space
  - 16 megabyte to 4 gigabyte physical
  - 64 terabyte virtual
  - 4 gigabyte maximum segment
- Integrated memory management unit
  - Virtual memory support
  - Optional on-chip paging
  - 4 levels of protection
  - Fully compatible with 80286
- Object code-compatible with all 8086 microprocessors
- Virtual 8086 mode allows running of 8086 software in a protected and pages system
- Hardware debugging support
- Numeric support via Intel387 math coprocessor
- Complete third-party system development support
  - Languages
  - Debuggers, linkers, locators
  - ICE™ In-Circuit Emulators

  - Design kits and reference designs
  - Simulators
  - Real-time OS
  - ROM DOS/Windows
  - BIOS
  - Chipsets

Intel386 CX Microprocessor – Includes the features of the Intel386 SX processor and:

- Static Intel386 processor core
  - Low power consumption
  - Operating power supply 2.7V to 5.5V
- Large uniform address space
  - 64 megabyte physical
  - 64 terabyte virtual
  - 4 gigabyte maximum segment size
- Transparent power-management system architecture
  - System management mode
  - Power management transparent to operation system and application programs
- iRMX EMB Royalty-free real-time operating system

Intel386 EX Microprocessor – Includes the features of the Intel386 CX processor and:

- Integrated peripheral functions:
  - Powerdown mode
  - Integrated peripheral functions
  - Clock and Power Management Unit
  - Chip Select Unit
  - Interrupt Control Unit
  - Timer/Counter Unit
  - Watchdog Timer Unit
  - Asynchronous Serial I/O Unit
  - Synchronous Serial I/O Unit
  - Parallel I/O Unit
  - DMA and Bus Arbiter Unit
  - Refresh Control Unit
  - JTAG Boundary Scan Unit

4.3 80C186 EMBEDDED PROCESSORS ARCHITECTURE

Intel's 80C186 integrated microprocessor product architecture is the industry standard among high-integration microprocessors. The traditional Intel architecture is highly successful in the embedded world with over 6,000 design wins in applications ranging from cellular phones to LAN boards, modems and hard disk drives. Intel's next-generation 80C186 products, the 80C186EC/EB/EA, are in production now. Based on the static, 1-micron 186 modular core, the EC/EB/EA operates at up to 20 MHz at 5V. For power-sensitive applications, 3V versions are also available. Intel has a broad portfolio of 186 integrated microprocessors to choose from to meet varying peripheral, performance, power and packaging requirements.

Also refer to the *Embedded Quick Reference Guide*, Order No. 272439.

Features

- 8086 instruction set
- 1-Mbyte addressing
- On-chip peripherals (timer/counters, DMA, interrupt controller, serial ports, etc.)
- Power management unit
- 3V versions available

Benefits

- High performance
- Uses PC for easy software development and debugging
- Large address space for programs and data
- High integration enables low-cost and low chip count design
- Efficient power consumption
- Enables portable, battery-powered designs
- Can select from portfolio of 186 integrated microprocessors to meet application requirements

Applications

- Cellular phones
- LAN boards
- Modems and fax boards
- Hard disk drives, tape drives
- Portable, hand-held terminals
- Multiplexers and PBXs

Table 4-1. 80C186 Microcontroller Component Specifications

Product Name	Speed (MHz)	3V Device	Static Design	Input Levels	Integrated Clock Generator	DMA Channels	Timers/ Counters	WDT	Chip-Select Ready Logic	Chip Select Pins	I/O Pins	Integrated Interrupt Controller	SIO	Refresh Control Unit	Process	Pkg.	ONCE Test Mode	Power Options
80186/ 80188	8	No	No	TTL	Yes	2	3	No	186-style	13	0	Yes	0	No	HMOS	A-68 N-68 R-68	No	
80C186XL/ 80C188XL	12.5, 20	No	Yes	TTL	Yes	2	3	No	186-style	13	0	Yes	0	Yes	CHMOS	A-68 N-68 R-68 S-80 SB-80	Yes	Power-save
80C186EA/ 80C188EA*	13,20	No	Yes	CMOS	Yes	2	3	No	186-style	13	0	Yes	0	Yes	CHMOS	N-68 S-80 SB-80	Yes	Power-save, power-down, idle
80L186EA/ 80L188EA*	8,13	Yes	Yes	CMOS	Yes	2	3	No	186-style	13	0	Yes	0	Yes	CHMOS	N-68 S-80 SB-80	Yes	Power-save, power-down, idle
80C186EB/ 80C188EB*	13,20	No	Yes	CMOS	Yes	0	3	No	Enhanced	10	16	Yes	2	Enhanced	CHMOS	N-84 S-80 SB-80	Yes	Power-down, idle
80L186EB/ 80L188EB*	8,13	Yes	Yes	CMOS	Yes	0	3	No	Enhanced	10	16	Yes	2	Enhanced	CHMOS	N-84 S-80 SB-80	Yes	Power-down, idle
80C186EC/ 80LC188EC*	13,20	No	Yes	CMOS	Yes	4	3	Yes	Enhanced	10	22	8259 compatible	2	Enhanced	CHMOS	KU-100 S-100 SB-100	Yes	Power-save, power-down, idle
80L186EC/ 80L188EC*	13	Yes	Yes	CMOS	Yes	4	3	Yes	Enhanced	10	22	8259 compatible	2	Enhanced	CHMOS	KU-100 S-100 SB-100	Yes	Power-save, power-down, idle

*−40°C to +85°C operation standard

PACKAGES:

A = Ceramic Pin Grid Array (PGA)
R = Ceramic Leadless Chip Carrier (LCC)
N = Plastic Leaded Chip Carrier (PLCC)
S = Quad Flatpack (QFP–EIAJ)
KU = Plastic Quad Flatpack (PQFP–JEDEC)
SB = Shrink Quad Flatpack (SQFP–EIAJ)

4.4 80186 ARCHITECTURE TOOLS

Bringing a new product to market on time and within budget depends on a smooth and efficient development process. Intel third-party vendors offer a wide variety of fully integrated hardware and software development tools designed to take advantage of the 8086/8088 and 80C186/80C188 microprocessor architectures. These tools include many advanced features and are also easy to use.

For the most complete and up-to-date information refer to the *Embedded Quick Reference Guide*, Order No. 272439, and the *80186/80C186 Architecture Development Tools Line Card*, Order No. 272344.

4.5 MCS® 96 EMBEDDED MICROCONTROLLER ARCHITECTURE

Intel's MCS® 96 embedded microcontroller architecture is the world's leading 16-bit microcontroller architecture. The MCS 96 architecture is optimized for real-time event control applications and is used widely in industrial, automotive and military designs. Intel offers a large variety of MCS 96 microcontroller products with different levels of performance and integration. You can select the MCS 96 microcontroller that meets your specific application requirements. Intel will continue to introduce new MCS 96 microcontroller products that meet evolving customer needs and allow existing designs to be upgraded.

Features

- 16-bit CPU (operating up to 20 MHz)
- Register-to-register architecture
- On-chip memory (up to 32-Kbyte OTP/ROM)
- On-chip peripherals (e.g., timer/counters, A/D, interrupt controller, serial ports, I/O ports, HSI/O, EPA)
- Idle and power-down modes

Benefits

- High performance
- No accumulator bottleneck; simpler, more efficient code
- Enables single-chip designs
- Variety of performance points to meet specific application requirements
- High integration enables low-cost and low chip count designs
- Efficient power consumption
- Superb performance today with future upgradability

Applications

- Motor control (AC, DC)
- Printers and copiers
- Hard disk drives, tape drives
- Modems and fax boards
- UPS (uninterruptable power supplies)
- Air conditioners
- Engine control

Table 4-2. MCS® 96 Microcontroller Component Specifications

Device	ROM/ OTPROM	Register RAM	Code RAM	Timer/ Counters	Analog Input Channels	I/O Pins	Event I/O Type	Serial Ports	Speed (MHz)	Process	Pkg.	Once Test Mode	Address Space	Key Features
8X9XBH*	8K	232	No	2	8	48	HSIO	1	12	HMOS	N-68 U-64 P-48	No	64K	8/16-bit bus, register-to-register architecture
8X9XJF	16K	232	256	2	8	48	HSIO	1	12	HMOS	N-68 U-64	No	64K	16K OTPROM, internal (Code) RAM version of BH
8XC196KB*	8K	232	No	2	8	48	HSIO	1	12, 16	CHMOS	N-68 S-80	Yes	64K	16-bit performance with A/D on-chip, 8K ROM
8XC198	8K	232	No	2	0,4	48	HSIO	1	16	CHMOS	N-52 S-80	Yes	64K	8-bit bus, 0 or 4 channel version of KB
8XC196KC*	16K	488	No	2	8	48	HSIO	1	16, 20	CHMOS	N-68 S-80 SB-80	Yes	64K	16K OTPROM, 488 byte RAM 3-PWM, PT
8XC196KD*	32K	1000	No	2	8	48	HSIO	1	16, 20	CHMOS	N-68 S-80 SB-80	YES	64K	32K OTPROM, 1000 byte RAM version of KC
8XC196MC	16K	488	No	2	13	53	8 EPA	1	16	CHMOS	N-84 S-80 U-64	Yes	64K	PTS, PWM, 3-phase waveform generator
8XC196MD	16K	488	No	2	14	64	12 EPA	1	16	CHMOS	N-84 S-80 U-64	Yes	64K	MC enhancement with frequency generator
8XC196JQ*	12K	360	128	2	8	41	6 EPA	2	16	CHMOS	N-52	Yes	64K	6 EPA, 6 A/D, 52L package
8XC196JR*	16K	488	256	2	8	56	10 EPA	2	16	CHMOS	N-52	YES	64K	6 EPA, 6 A/ D, 52L package, more memory than JQ
8XC196KQ*	12K	360	128	2	8	41	6 EPA	2	16	CHMOS	N-68	Yes	64K	10 EPA, 8 A/D, 56 I/O lines, 12K OTPROM
8XC196KR*	16K	488	256	2	8	56	10 EPA	2	16	CHMOS	N-68	YES	64K	Memory scaler version of KQ
8XC196KT*	32K	1000	512	2	8	56	10 EPA	2	16	CHMOS	N-68	Yes	64K	Memory scaler version of KR with enhanced bus controller
8XC196NP	4K	1000	No	2	0	33	4 EPA	1	24	CHMOS	S-100 SB-100	Yes	1M	**Low power 3.3 volts**, 6 chip selects, MUX/DeMUX dynamic bus, 3 PWMs, PTS, no A/D, 4 ext. int. added, no OTP
8XC196NT*	32K	1000	512	2	4	56	10 EPA	2	16	CHMOS	N-68	Yes	1M	1 Mbyte linear address range

*Automotive temperature versions available

PACKAGES:
N = Plastic Leaded Chip Carrier (PLCC)
P = Plastic Dual In-Line Package (PDIP)
S = Quad Flatpack (QFP–EIAJ)
SB = Shrink Quad Flatpack (SQFP–EIAJ)
U = Shrink Dual In-Line package (SDIP)

4.6 MCS 96 MICROPROCESSOR DEVELOPMENT TOOLS

4.6.1 Product Evaluation Kit

The Project Builder 196 is a turnkey project kit for the 196KB/KC or CD.
Order Code: PROJBLD196KBCD

Features

- 196KD 20-MHz target board
- Retargetable symbolic debug monitor
- Demo ASM-96
- *Model*BUILDER application modeling and profiling software
- *Ap*BUILDER microcontroller code generation tool
- Windows 3.1-based
- Demo C-196 compiler with product registration
- CAD schematic files and library
- Hypertext technical manuals
- Hypertext data sheets

Benefits

- Low-cost kit for the 196KB/KC or KD
- Everything necessary to evaluate the 196KB/KC or KD microcontroller

4.6.2 Fuzzy Logic Kits

Project Builder 196 plus Fuzzy Logic tools give you a turnkey environment to develop leading-edge applications. Produce highly optimized C code with ASM96 kernel calls for the MCS 96 microcontroller architecture. Interface your fuzzy system to the 196 using *Ap*BUILDER to generate peripheral code.

4.6.2.1 fuzzyBUILDER EXPLORER 96 Order Code: FUZZYBLDREXP96

Features

- Includes Project Builder kit
- Full graphic environment
- Interactive crane simulation model
- User manual and on-line help system
- Point and click ease of use
- Turnkey hardware and software environment
- Connect target board to project hardware via board edge connectors

Benefits

- Fast to learn, easy to use
- For small systems development and training
- Hands-on learning
- Low cost

4.6.2.2 fuzzyBUILDER MCU-96 Order Code: FUZZYBLDRMCU96

Features

- Includes Project Builder 196
- Fuzzy logic tool
- Graphical environment
- Graphic editors
- Debug functions

Benefits

- For development of large systems
- Easy to use

4.6.2.3 fuzzyBUILDER REAL-TIME REMOTE CROSS DEBUGGER 96 Order Code: FUZZYBLDRXDB96

Features

- MCU-96 developers tools
- Real-time remote cross debugger

Benefits

- Optimize a fuzzy system in real time while it is running
- Geographical display of running system behavior
- Saves time

4.6.2.4 fuzzyBUILDER NEUROFUZZY KIT 96 Order Code: FUZZYBLDRNFK96

Features

- Includes Project Builder 196
- MEU-96 developer tools
- NeuroFuzzy module
- Generates fuzzy system rules from input and output data
- Rule locking with selective learning
- User-defined learning algorithms

Benefits

- Build adaptive systems
- Learn from sample data
- Flexible
- Generate and optimize a fuzzy system

4.6.3 MCS 96 Microcontroller Language/Utilities

4.6.3.1 OPTIMIZING C COMPILER

Features

- iC-96 optimized for real-time embedded applications
- Conforms to the ANSI C standards

Benefits

- High-level language software development

4.6.3.2 MACRO ASSEMBLER

Features

- ASM-96 Assembler translates symbolic assembly mnemonies into relocatable object code

Benefits

- Development of performance-critical code

4.6.3.3 PL/M COMPILER

Features

- PLM/96 compiler translates high-level language statements into relocatable object code

Benefits

- High-level programming
- Ease of maintenance

4.6.3.4 ICE™ 196KD/HX AND 196KD/PC IN-CIRCUIT EMULATORS

Features

- Real-time emulation up to 20 MHz
- Mappable memory
- Trace debugger
- Symbolic debugging
- Supports all variations of 8XC196KB, KC, KD, 8XC194, 8XC198 architectures

Benefits

- Fast development of on-target software
- Software debug and (EP)PROM simulation prior to hardware availability
- Storing real-time execution trace history
- Faster and easier access to memory location and program variables

4.7 MCS 51 EMBEDDED MICROCONTROLLER ARCHITECTURE

Intel's MCS 51 embedded microcontroller architecture is the industry-standard 8-bit microcontroller architecture. The MCS 51 microcontroller architecture is optimized for control-oriented applications. Intel offers a wide variety of MCS 51 microcontroller products with different levels of on-chip peripherals and memory. The MCS 51 microcontroller architecture includes versions with on-chip EPROM, OTP and ROM memory, as well as CPU only. Intel also offers a wide selection of low-voltage products. As a result, with the MCS 51 microcontroller architecture, you can select the microcontroller that exactly meets your specific requirements.

For the most complete and up-to-date information, refer to the *Embedded Quick Reference Guide*, Order No. 272439.

Features

- 8-bit CPU optimized for event control
- Boolean processing
- On-chip memory (up to 32 Kbytes)
- On-chip peripherals (timer/counters, serial ports, A/D, I/O ports, PCA, etc.)

Benefits

- Efficient event control design
- Easy and simple bit manipulation
- Enables single-chip designs
- High integration enables low-cost and low chip count designs

Applications

- Telephones, answering machines
- Keyboards, digitizers
- Hard disk drives
- Appliance control panels
- Alarm systems
- Instrument panels

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5

Flash Memory Products

CHAPTER 5
FLASH MEMORY PRODUCTS

5.1 FLASH MEMORY CARD FAMILY

Intel Flash Memory Cards represent the most advanced form factor for removable memory in portable computing and embedded memory environments. Intel supports the PCMCIA 2.1/ JEIDFA 4.1 standard 68-pin interface for interoperability between PCs, fax machines, bar code readers and other devices. The flash card's solid-state characteristics, small form factor and nonvolatility make it ideal for applications requiring rugged, removable firmware and data storage.

5.1.1 Series 2 and Series 2+ Flash Memory Cards

Intel's Series 2 and Series 2+ Flash Memory Cards employ the Microsoft Flash File System to provide high-performance disk emulation in PCs and dedicated equipment. Series 2 cards are the removable nonvolatile storage solution of choice in any application in which high performance, ruggedness, long battery life and light weight are critical. Based on Intel 8-Mbit FlashFile™ Memory Components, the cards feature a symmetrically blocked architecture that allows them to retain code and data while erasing or writing to other blocks.

5.1.2 Series 1 Flash Memory Cards: Program Storage and Data Acquisition

True nonvolatility, rewrite flexibility and proven cost effectiveness make Intel Series 1 Flash Memory Cards the ideal medium for storing and updating application code.

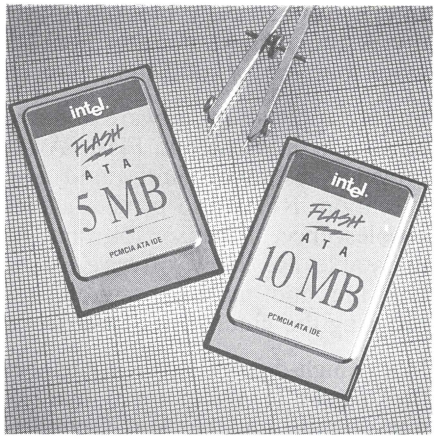
Table 5-1. Intel Flash Memory Card Family Specifications

Product Name	Density x Org	PCMCIA Card Type	# Pins	Access Time (ns)	
				$5.0V_{CC}$	$3.3V_{CC}$
Series 2+ Flash Memory Cards PCMCIA Standard Interface					
iMC040FLSP	40 Mbyte, x 8/ x 16	Type 1	68	150	200
iMC020FLSP	20 Mbyte, x 8/ x 16	Type 1	68	150	200
iMC004FLSP	4 Mbyte, x 8/ x 16	Type 1	68	150	200
Series 2 Flash Memory Cards PCMCIA Standard Interface					
iMC020FLSA	20 Mbyte, x 8/ x 16	Type 1	68	200	N/A
iMC010FLSA	10 Mbyte, x 8/ x 16	Type 1	68	200	N/A
iMC004FLSA	4 Mbyte, x 8/ x 16	Type 1	68	200	N/A
iMC002FLSA	2 Mbyte, x 8/ x 16	Type 1	68	200	N/A
Series 1 Flash Memory Cards PCMCIA Standard Interface					
iMC004FLKA	4 Mbyte, x 8/ x 16	Type 1	68	200	N/A
iMC002FLKA	2 Mbyte, x 8/ x 16	Type 1	68	200	N/A
iMC001FLKA	1 Mbyte, x 8/ x 16	Type 1	68	200	N/A

PACKAGE: Type 1 = PCMCIA Memory Card

5.2 FLASH DRIVE FAMILY

Intel's Flash Drive brings the mass storage advantages of Intel's FlashFile memory to mobile computers equipped with the PCMCIA-ATA or IDE interface. Offering up to 10 Mbyte of nonvolatile storage, the iFD010P2SA provides the battery life, performance, ruggedness, reliability and silent operation needed by leading-edge mobile computing applications.



The flash drive extends system battery life by only using power when it needs it. There are no spinning disks continually consuming power. Automatic integrated power management reduces current without special system BIOS support. Systems can have battery life extended up to 100% by the flash drive.

The flash drive is compatible with the PCMCIA-ATA specification. Typically, no additional system software drivers are required.

With its Type 2, 5mm form factor, the flash drive is very compact—only one-half the thickness of a 1.8″ Type 3 hard disk drive—allowing two PCMCIA cards to occupy the space of one disk drive.

The flash drive's solid state construction yields high performance and a 1000g shock specification. Also, Intel's Flash Memory reliability provides the ultimate in data integrity for critical data applications.

Table 5-2. Intel Flash Drive Family

Product Name	Density	PCMCIA Card Type	# Pins	Access Time (ns)
				$5.0V_{CC}$
iFD010P2SA	10 Mbyte	Type 2	68	<1 ms
iFD005P2SA	5 Mbyte	Type 2	68	<1 ms

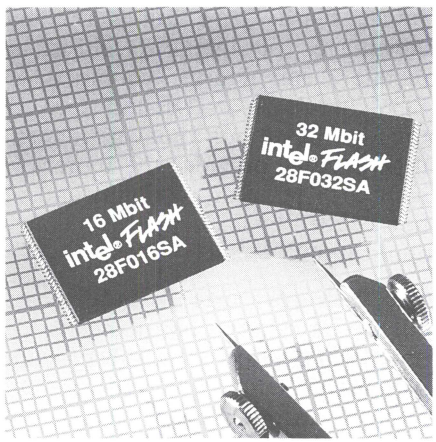
PACKAGE: Type 2 = PCMCIA-ATA Memory Card

5.3 FLASHFILE™ COMPONENT FAMILY

Intel's symmetrically blocked FlashFile memory is the highest density, nonvolatile, read/write solution for solid-state mass storage.

Storing application software and operating system code in Resident Flash Arrays (RFAs) provides instant-on and rapid in-place code execution. RFAs also protect against software obsolescence, because software is in-system updatable. Resident software extends the battery life and increases system reliability by reducing the number of disk-drive accesses.

Many high-density applications benefit from the FlashFile component family's inherent nonvolatility and blocked architecture, which allow for flexible firmware updates or magnetic disk replacement.



Applications

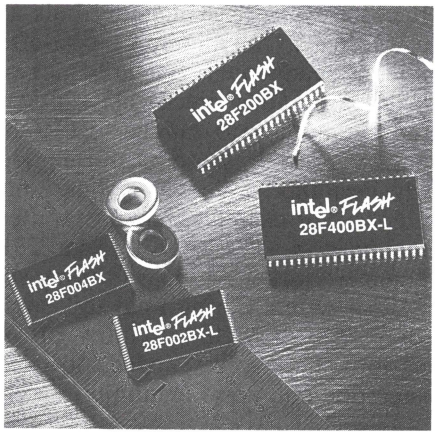
- Mobile companions
- Telecommunications
- Networking equipment
- Diskless workstations and terminals
- Laser printers
- Data loggers

Table 5-3. Intel FlashFile™ Component Family

Product Name	Density x Org	Package	# Pins	Access Time (ns)	
				$5.0V_{CC}$	$3.3V_{CC}$
28F032SA	32 Mb, 4M x 8/2M x 16	DD	56	70,100	120,150
28F016SA	16 Mb, 2M x 8/1M x 16	E	56	70,100	120,150
28F008SA	8 Mb, 1M x 8	E,F PA	40 44	85,120 85,120	200 200

PACKAGES: DD = Dual Die
E = TSOP
F = TSOP, Reverse Pinout
PA = PSOP

5.4 FLASH BOOT BLOCK COMPONENT FAMILY



The boot block flash memory family aids the system designer by combining the functions of several components into one package, providing an alternative to ROM, EPROM, EEPROM and/or battery-backed SRAM. Many embedded code applications, such as PC BIOS and cellular telephones, benefit from the combination of blocked architecture, automated write and erase and standard processor interface.

The 28F001BX-T/B consists of four separately erasable blocks, a boot block, two parameter blocks and one main block. The boot block sector includes a hardware reprogramming lockout feature to guarantee the reliability of critical boot code. Boot block components employ advanced CMOS circuitry for systems that require high-performance access speeds, low power consumption and noise immunity.

Intel 2-Mbit and 4-Mbit boot block flash memories provide designers with high-performance, high-integration, low-power and surface-mount options. In addition, these components provide an industry-standard upgrade path that supports both the addition of new features and the implementation of new protocols for PCs, telecommunications, office automation, scientific and technical equipment.

Table 5-4. Intel Flash Boot Block Component Family

Product Name	Density x Org	Package	# Pins	Access Time (ns)	
				5.0V_{CC}	3.3V_{CC}
28F400BX	4 Mb, 512K x 8/256K x 16	PA E	44 56	60,80 60,80	150 150
28F004BX	4 Mb, 512K x 8	E	40	60,80	150
28F200BX	2 Mb, 256K x 8/128K x 16	PA E	44 56	60,80 60,80	150 150
28F002BX	2 Mb, 256K x 8	E	40	60,80	150
28F001BX	1 Mb, 128K x 8	P,N,E	32	TBD, 120,150	N/A

PACKAGES: PA = PSOP
E = TSOP
P = Plastic DIP
N = PLCC

5.5 FLASH BULK-ARRAY COMPONENT FAMILY

Intel's CMOS flash memory bulk-array products offer a full family of cost-effective and reliable read/write nonvolatile memories. Flash technology adds electrical chip erasure and reprogramming to familiar EPROM technology. As a result, these products increase memory flexibility while saving time and costs for OEMs. For example, memory contents can be rewritten in a test socket, in an EPROM programmer socket, on-board during subassembly test, in-system during final test, and in-system after sale. CMOS circuitry provides high-performance access speed, low power consumption and noise immunity.

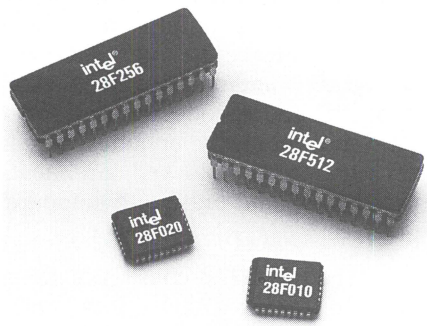


Table 5-5. Intel Flash Bulk-Array Component Family

Product Name	Density x Org	Package	# Pins	Access Time (ns)
				$5.0V_{CC}$
28F020	2 Mb, 256K x 8	P,N,E,F	32	70,90,150,200
28F010	1 Mb, 128K x 8	E,F,P,N	32	65,90,120,150
28F512	512 K, 64K x 8	P,N	32	120,150,200
28F256A	256 K, 32K x 8	P,N	32	120,150,200

PACKAGES: P = Plastic DIP
N = PLCC
E = TSOP
F = TSOP. Reverse Pinout

6

Programmable Logic Devices

CHAPTER 6
PROGRAMMABLE LOGIC DEVICES

Designing higher speed systems based on the Pentium, Intel486 and i960 processors presents an expanded set of design challenges. Intel CMOS PLDs and FPGAs are designed to help master performance, predictability, heat dissipation, noise suppression and metastability with quality and reliability.

With high-speed, low-power consumption, and a range of integration capabilities, Intel PLDs are ideally suited for high-performance microcomputer system applications.

6.1 FLEXlogic FPGA FAMILY

Intel's iFX780 and iFX740 are the first two members of the Intel FLEXlogic family. Both combine the speed and ease-of-use of PLDs with the logic and density of FPGAs to give you the greatest design flexibility available.

The iFX780's flexible architecture contains 80 macrocells arranged in eight Configuable Function Blocks (CFBs). You can use each CFB as either a block of 10 ns 24V10-like logic or as a block of 15 ns 128 x 10 SRAM. The iFX740 contains 40 macrocells making it an ideal solution for designs that require all the benefits of the iFX780 but half the density.

To maximize fit and resource utilization, the FLEXlogic macrocells can allocate product terms without losing the donor macrocell as a resource or incurring additional delay. The devices also feature an on-chip 10 ns 12-bit identity comparator for each CFB.

Both devices features 12 clock options with a variety of set-up and clock-to-output timings that can be adjusted to meet application needs. The FLEXlogic family delivers unmatched speed, with predictable 10 ns pin-to-pin delays, even when implementing 16 product term equations. I/O pins can be configured as either 3.3V or 5V, allowing the device to serve as a bridge between subsystems of different voltages. With CFBs configurable as SRAM, you gain even more design flexibility. You don't have to include additional devices when you need memory.

Features

- 10 ns at 80-MHz system performance
- Flexible clocking options
- Low power consumption
- CFBs configurable at 15 ns SRAM
- Reconfigurable
- Built-in CFB comparator

Benefits

- Predictable performance
- Ability to customize timing to your application
- Increases system reliability
- Memory or logic in one device provides increased design flexibility
- In-system prototyping
- Provides 12-bit identity comparisons with speed and efficiency

Applications

- Telecommunications
- Data communications
- Embedded Control
- Computing
- Industrial Control

6.2 iPLD22V10 PROGRAMMABLE LOGIC DEVICE FAMILY

Intel's PLD22V10 is a high-performance CMOS PLD that is function-, lead- and JEDEC-file compatible with the industry-standard 22V10 device.

It accommodates logic functions with up to 22 inputs and 10 I/O macrocells. I/O macrocells feature 8 to 16 product terms (p-terms) for implementing logic and a separate p-term for output enable control. Manufactured on Intel's 1-micron CHMOS-IIIE process, the iPLD22V10 has a propagation delay (T_{pd}) of 7.5 ns and supports system clock speeds of 111 MHz. This performance is achieved at a 40 percent power reduction compared to bipolar 22V10s and without the noise associated with CMOS GAL* devices. As a low-heat solution, it reduces temperature and eliminates fuse-related failures, improving board reliability and reducing replacement costs.

The iPLD22V10 is ideal for implementing embedded controllers, complex state machines and microprocessor-based system glue logic.

Features

- 7.5 ns T_{pd}, 3 ns t_{su} 111-MHz system clock speed support
- 10 macrocells, 12 dedicated inputs and 10 I/O
- Socket and JEDEC-compatible with industry-standard 22V10 and 22VP10
- Produced on Intel's 1-micron CHMOS-IIIE technology
- Programmable inverted clock, configurable by macrocell (85C22V10 only)
- 40 percent lower power than bipolar 22V10s technology
- 3.3V core logic and I/O (iPLDLV22V10 only)
- 35mA max I_{CC} (iPLDLV22V10 only)

Benefits

- Compatible with high-speed system designs
- High integration capability
- Lower power consumption and low heat solution improves board reliability and reduces replacement costs
- Increase board flexibility

Applications

- Battery-operated and portable systems

6.3 iPLDLV22V10-5 PROGRAMMABLE LOGIC DEVICE

The iPLDLV22V10-5 is the ultimate simple PLD solution for your 3V design needs. It includes a New 3V process, Ultra-Low Active and Zero Power, Electrical Erasability, and Speed!

Two very important considerations in the development of mobile and portable systems are low power and flexibility. Intel proudly offers you a fast, real 3V, standard 22V10 programmable logic device. The ultra-low power of the iPLDLV22V10-5 is the perfect device to help you meet pressing extended battery life design goals. Additionally, its substantial heat reduction makes it easier to design to small form factor thermal requirements.

The iPLDLV22V10-5 offers incredible flexibility that will get your designs working and to market, fast. Intel realizes that your 3V system specs will frequently change with market demands, and as 3V product offerings grow. To help you meet your evolving design needs and manage even last minute change, the iPLDLV22V10-5 is programmable and electrically erasable. Most notably, it even allays common 3V performance fears. This ideal PLD truly has no equal. With 5 ns propagation delay and 145-MHz registered speed, all of your design challenges can be conquered...

Features

- Low voltage
- Low power
- High speed
- Standard 22V10 architecture

Benefits

- 3.3V core logic and I/O
- Reduces overall system power
- Increases system reliability and battery life

Applications

- Ideal for battery powered and portable systems. Supply voltage range 3.0V to 3.6V

6.4 iPLD610 PROGRAMMABLE LOGIC DEVICE

The iPLD610 is a performance upgrade for slower devices based on PLD architecture. It replaces the 5C060, EP600, EP610, EP610A, EP630, PALCE630, and multiple PAL-type/TTL logic devices.

Manufactured on Intel's CMOS technology for low power consumption, making it easier to design system power supply. As a low-heat solution, it reduces temperature and eliminates fuse-related failures, improving board reliability and reducing replacement costs.

As a programmable device, the iPLD610 can help decrease your time to market. The same design tools used for the 85C060, 5C060, EP600, EP610, EP610A, and EP630 can be used for the iPLD610. Thorough design documentation and third-party programming support are also available.

The iPLD610 supports any microprocessor running at 50 MHz or faster, including the Intel386, Intel486, i960 CA/KX and i860® microprocessors.

Features

- Produced on Intel's CMOS technology
- 16 macrocells, 16 I/O leads
- Registers configurable as D or T type
- Socket-compatible with 85C060, 5C060, EP600, EP610, EP610A, EP630 and PALCE630
- Comprehensive design documentation and guidelines

Benefits

- High-speed performance, 10 ns T_{pd}, 100 MHz
- Consumes less power and produces less heat than bipolar
- High integration capability, more outputs than the 22V10
- Optimum flexibility for implementing complex state machines and counters
- Industry-standard architecture allows use of same design tools
- Ease of design means faster time to market

Applications

- Embedded controllers, state machines, and general glue logic consolidation

6.5 iPLD910 PROGRAMMABLE LOGIC DEVICE

The iPLD910 is a performance upgrade for slower devices based on PLD architecture. It replaces the 85C090, 5C090, EP900, EP910 and EP910A.

Manufactured on Intel's CMOS technology for low power consumption, making it easier to design system power supply. As a low heat solution, it reduces temperature and eliminates fuse-related failures, therefore improving board reliability and reducing replacement costs.

The iPLD910 supports any microprocessor running at 33 MHz or faster, including the Intel386, Intel486, i960 CA/KX and i860 microprocessors.

As a reprogrammable device, the iPLD910 can improve your time to market. The same design tools used for the 85C090, the 5C090 and the Altera EP900, EP910 and EP910A can be used for the iPLD910. Thorough design documentation and third-party programming support are also available.

Features

- Produced on Intel's CMOS technology
- 24 macrocells, 24 I/O leads
- Socket-compatible with 85C090, 5C090, EP900, EP910 and EP910A
- Registers configurable as D or T type
- Comprehensive design documentation and guidelines

Benefits

- High-speed performance, T_{pd} = 12 ns, 62.5-MHz registered performance
- High integration capability
- Optimum flexibility for implementing complex state machines or counters
- Ease of design means faster time to market

Applications

- Embedded controlers, state machines, and general glue logic consolidation.

6.6 85C220/85C224 PROGRAMMABLE LOGIC DEVICE FAMILY

The 85C220/224 uses Intel's superior CMOS EPROM technology as logic control memory elements. The result is a device that offers a fast T_{pd} with power consumption much lower than bipolar and CMOS devices of equivalent speeds. EPROM technology allows these devices to be 100% factory tested by programming and erasing all of the EPROM logic control elements.

The 85C220 and 85C224 are a logical superset of most high-speed 20- and 24-lead PAL*/GAL devices. The I/O and logic sections of the device can be configured to replace or upgrade PAL/GAL 16V8 and 20V8 devices.

The 85C220 and 85C224 (-100 and -10) display dramatically reduced output pin skew in comparison with other industry clock driver products. With high-performance systems relying on increasingly faster clocking frequencies, managing the timing of high-frequency system clocks is now more important than ever. Whether the configuration is combinatorial (as with a clock driver) or registered (as with a frequency divider) the output skew (T_{OS}) is typically less than 250 picoseconds. The extremely low output skew of the 85C220 and 85C224 makes the devices ideal for a variety of high-frequency, system clock-related applications including Pentium and Intel486 microprocessors, and PCI bus designs.

Features

- 20- and 24-lead PAL/GAL superset
- High-performance based on Intel's CMOS EPROM technology
- All packages are 100% testable. The CerDIP package is reprogrammable
- Lower power consumption
- Low-noise output buffer

Benefits

- A one-part-fits-all solution that reduces inventory and paperwork
- Operates at up to 100-MHz max frequency with external feedback, and 115 MHz with internal feedback for high-performance registered applications
- Fast T_{pd} of 7.5 ns for high performance combinatorial applications
- Superior speed, low power, and low noise are ideal for today's critical design demands
- Low programming fallout, high reliability
- Excellent metastability characteristics
- Eliminates fuse-related failures
- Energy efficiency increases overall design reliability
- Standby mode for power-critical applications (80 and 66 MHz)
- Minimized transmission line effects; reduces ground bounce

Applications

- Advanced microprocessor systems
- PC expansion cards and peripherals
- Mobile systems
- Communications
- Digital design

6.7 ADVANCED ARCHITECTURE PLD FAMILY (5AC312/5AC324)

Intels' advanced architecture, general-purpose CMOS PLD (programmable logic device) family represents an innovative approach to overcoming the primary limitations of standard PLDs. Due to proprietary I/O architecture and macrocell structure, these PLDs are capable of implementing high-performance logic functions very effectively. They feature dual feedback, p-term allocation, set/reset/OE p-terms, programmable inputs, and synchronous/asynchronous clocks. They can be used as an alternative to low-end gate arrays, multiple programmable logic devices or LS-, HC- or HCT SSI and MSI logic devices. Input and macrocell features for the 5AC312 and 5AC324 are a superset of features offered by other PLD-type products.

These devices use advanced Intel CMOS EPROM cells instead of poly-silicon fuses as logic control elements. This technology allows these PLDs to operate at levels necessary in high-performance systems while significantly reducing power consumption. Their programmable stand-by function reduces power consumption to almost zero in applications where a slight speed loss is traded for power savings.

Features

- Programmable low-power option for stand-by operation
- High-performance LSI semi-custom logic alternative for low-end gate arrays, TTL, and 74HC- or 74HCT SSI and MSI logic, and PLDs
- High-speed T_{pd} 25 ns, 66-MHz performance pipelined, 33.3 MHz with feedback
- Flow-through input or global CLK pin; 1 flow-through input or global ILE/ICLK pin
- Programmable AND, allocatable OR design allows up to 16 p-terms per macrocell
- Software-supported p-term allocation between adjacent macrocells
- Programmable output registers configurable as D, T, JK, or SR types
- Dual feedback on all macrocells for implementing buried registers with bi-directional I/O

Benefits

- Provides innovative solution to problems imposed by standard PLD limitations
- Can operate at levels necessary in high-performance systems while significantly reducing power consumption

Applications

- General purpose PLDs; interface logic, state machine sequences/ controllers, flexible I/O Architecture

6.8 5CXXX STANDARD ARCHITECTURE PLDs

Intels' standard architecture PLDs are fully compatible with the EP310, EP320, EP600, and EP1800. The 5CXXX family uses CMOS EPROM cells as logic control elements instead of fuses. This reduces the power consumption of PLDs to less than 20% of a comparable bipolar device without sacrificing performance. In addition, the use of Intel's advanced CMOS EPROM process technology enables greater logic densities to be achieved with superior speed and lower power performance over comparable devices.

For ease of design and fast time to market, Intel provides a full library of design entry, simulation, compilation and programming tools for the 5CXXX PLD family. An aggressive program of third-party design support is also in place with vendors such as DATA I/O, Logical Devices, ViewLogic, STAG, OrCad and Omation.

Features

- Industry-standard architecture
- Programmable low-power option

Benefits

- Superior speed and low-power performance
- 100% socket-compatible with EP310, EP320, EP600, EP900, EP1800
- Energy efficiency increases system reliability without sacrificing performance

Table 6-1. Intel High-Performance FLEXlogic Devices

Product Name	Pkgs	Pins	Mcells (Regs)	I/O	t_{PD} (ns)	f_{CNT1} (MHz)	t_{SU} (ns)	t_{CO} (ns)	I_{OL} (mA)	I_{CC} (mA)@ Freq. (MHz)	Device Type/Application
FX780	N KU	84 132	80 80	60 102	10,15 10,15	80 80	6.5 6.5	6.0 6.0	12 12	120 @ 80 120 @ 80	Highest performance FPGA, SRAM option 3.3V support, JTAG interface, 5000 gates
FX740	N N	44 68	40 40	30 50	10,15 10,15	80 80	6.5 6.5	6.0 6.0	12 12	80 @ 80 80 @ 80	Highest performance FPGA, SRAM option 3.3V support, JTAG interface, 2500 gates

PACKAGES: N = Plastic J-lead chip carrier (one-time programmable)
KU = Plastic quad flat pack (one-time programmable)

Table 6-2. Intel High-Performance Industry-Standard Devices

Product Name	Pkgs	Pins	Mcells (Regs)	I/O	t_{PD} (ns)	f_{CNT1} (MHz)	t_{SU} (ns)	t_{CO} (ns)	I_{OL} (mA)	I_{CC} (mA)@ Freq. (MHz)	Device Type/Application
PLD22V10	P,N	24, 28	10	22	7.5, 10,15	111	3	6	16	130@15	High-speed, 22V10
PLDLV22V10	P,N	24, 28	10	22	15	50	10	10	16	35@15	Low-voltage PLD—3.3V core logic and I/O
PLD610	D,P, N	24, 28	16	20	10,15, 25	74	7	6.5	12	105@1	High-speed, general-purpose; EP610/EP630 speed upgrade—low-power stand-by mode
PLD910	D,P, N	40, 44	24	36	12,15, 25	66.7	8	7	12	150@1	High-speed, general purpose; EP910 speed upgrade—low-power stand-by mode

PACKAGES: D = Ceramic dual in-line package (windowed for UV erase)
N = Plastic J-lead chip carrier (one-time programmable)
P = Plastic dual in-line package (one-time programmable)

Table 6-3. Intel Extended Feature Devices

Product Name	Pkgs	Pins	Mcells (Regs)	I/O	t_{PD} (ns)	f_{CNT1} (MHz)	t_{SU} (ns)	t_{CO} (ns)	I_{OL} (mA)	I_{CC} (mA)@ Freq. (MHz)	Device Type/Application
5AC312	D,P, N	24, 28	12	22	25, 30	33.3	15	15	8	100@33.3	Advanced architecture, general purpose: dual feedback, p-term allocation, 2 set/reset OE p-terms, synchronous/asychronous clocks
5AC324	D,P, N	40, 44	24	36	25, 30	33	12.5	17.8	8	175@33	Advanced architecture, general purpose: dual feedback, p-term allocation, 2 set/reset OE p-terms, synchronous/asychronous clocks
5C031	D	20	8	18	40,50	22	30	24	4	40@10	General-purpose PLDs; interface logic, state machine sequencers/controllers, flexible I/O architecture
5C032	D,P	20	8	18	30,35, 40	25	23	17	4	30@25	General-purpose PLDs; interface logic, state machine sequencers/controllers
5C060	D,P, N	24 28	16	20	45,55	16.6	38	22	4	95@96.6	General-purpose PLDs; interface logic, state machine sequencers/controllers
5C090	D,P, N	40 44	24	36	50,60	16.4	38	23	4	150@16.4	General-purpose PLDs; interface logic, state machine sequencers/controllers
5C180	N	68	48	64	70,75, 90	12.1	53	29	4	200@12.2	General-purpose PLDs; interface logic, state machine sequencers/controllers
85C220-80/66	D,P, N	20 20	8	18	10,12	80	7	5.5	12	60@80	High-speed, 20-pin PAL*/GAL* superset (register optimized) – low-power stand-by mode
85C220-100	N	20	8	18	7.5	100	4.5	5.5	24	115@100	High-speed, 24-pin PAL/GAL superset (register optimized)
85C220-7/10	N	20	8	18	7.5,10	74	7	6.5	24	105@74	High-speed, 20-pin PAL/GAL superset (t_{PD} optimized)
85C224-80/66	D,P, N	24 28	8	22	10,12	80	7	5.5	12	60@80	High-speed, 24-pin PAL/GAL superset (t_{pd} optimized) – low-power stand-by mode
85C224-100	N	28	8	22	7.5	100	4.5	5.5	24	115@100	High-speed, 24-pin PAL/GAL superset (register optimized)
85C224-7/10	N	28	8	22	7.5,10, 15, 25	74	7	6.5	24	105@74	High-speed, 24-pin PAL/GAL superset (register optimized)
85C22V10	D,P, N	24 28	10	22	10,15	71.4	7	7	16	130@15	High-speed, 22V10 superset; invertible CLK, expanded feedback options

PACKAGES: D = Ceramic dual in-line package (windowed for UV erase)
N = Plastic J-lead chip carrier (one-time programmable)
P = Plastic dual in-line package (one-time programmable)
M = Military versions available (same speeds/packages); refer to *Military Handbook*, (210461)

*Other brands and names are the property of their respective owners.

7

Automotive Products

CHAPTER 7
AUTOMOTIVE PRODUCTS

7.1 MCS 51 MICROCONTROLLER AUTOMOTIVE FAMILY

Intel's MCS 51 embedded microcontroller family is an industry-standard 8-bit microcontroller architecture. The MCS 51 microcontroller family is optimized for high-performance, event control-oriented applications. Intel offers a wide variety of MCS 51 microcontroller products with different levels of on-chip peripherals and memory. The MCS 51 microcontroller family includes versions with on-chip EPROM, OTP and ROM memory as well as CPU only. As a result, with the MCS 51 microcontroller family you can select the microcontroller that meets specific application requirements.

Features

- 8-bit CPU optimized for event control
- Boolean processing
- On-chip memory (up to 32 Kbytes)
- On-chip peripherals (timer/counters, serial ports, I/O ports, PCA, etc.)

Benefits

- Efficient event control design
- Easy and simple bit manipulation
- Enables single-chip designs
- High integration enables low-cost and low chip count design

Applications

- Anti-lock braking controls
- Trip computers
- Keyless entry
- Climate control
- Cruise control
- Air bags
- Entertainment
- Injection/ignition control

Table 7-1. MCS® 51 Microcontroller Automotive Family Specifications

Product Name	Process	Internal Memory		Timers/ Counters	Interrupts	Programmable I/O Lines	Serial Ports	Extra Features	Frequency Range Offered (MHz)	Package Types
		Program	Data							
87C51FC	CHMOS	32K x 6 EPROM	256 x 8 RAM	3 x 16-bit	7	32	1	1 x 5 PCA channels	3.5-12/16/20	40-Pin PDIP, 44-Pin PLCC
87C51FB	CHMOS	16K x 6 EPROM	256 x 8 RAM	3 x 16-bit	7	32	1	1 x 5 PCA channels	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
87C51FA	CHMOS	8K x 6 EPROM	256 x 8 RAM	3 x 16-bit	7	32	1	1 x 5 PCA channels	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
83C51FA	CHMOS	8K x 8 ROM	256 x 8 RAM	3 x 16-bit	7	32	1	1 x 5 PCA channels	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
80C51FA	CHMOS	NONE	256 x 8 RAM	3 x 16-bit	7	32	1	1 x 5 PCA channels	3.5-12	40-Pin PDIP, 44-Pin PLCC
87C54	CHMOS	16K x 6 EPROM	256 x 8 RAM	3 x 16-bit	7	32	1	N/A	3.5-12/16/20	40-Pin PDIP, 44-Pin PLCC
87C51	CHMOS	4K x 8 EPROM	128 x 8 RAM	2 x 16-bit	5	32	1	N/A	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
80C51BH	CHMOS	4K x 8 ROM	128 x 8 RAM	2 x 16-bit	5	32	1	N/A	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
80C31BH	CHMOS	NONE	128 x 8 RAM	2 x 16-bit	5	32	1	N/A	3.5-12/16	40-Pin PDIP, 44-Pin PLCC
8052AH	HMOS	8K x 8 ROM	256 x 8 RAM	3 x 16-bit	6	32	1	N/A	3.5-12	40-Pin PDIP, 44-Pin PLCC
8032AH	HMOS	NONE	256 x 8 RAM	3 x 16-bit	6	32	1	N/A	3.5-12	40-Pin PDIP, 44-Pin PLCC
8051AH	HMOS	4K x 8 ROM	128 x 8 RAM	2 x 16-bit	5	32	1	N/A	3.5-12	40-Pin PDIP, 44-Pin PLCC
8031AH	HMOS	NONE	128 x 8 RAM	2 x 16-bit	5	32	1	N/A	3.5-12	40-Pin PDIP, 44-Pin PLCC

intel®

7.2 MCS 96 MICROCONTROLLER AUTOMOTIVE FAMILY

Intel's MCS 96 embedded microcontroller family is the industry-standard 16-bit microcontrollers. The MCS 96 microcontroller family is optimized for high-performance, event control-oriented applications. Intel offers a wide variety of MCS 96 microcontroller products with different levels of on-chip peripherals and memory. The MCS 96 microcontroller family includes versions with on-chip EPROM, OTP and ROM memory as well as CPU only. As a result, with the MCS 96 microcontroller family you can select the microcontroller that meets specific application requirements.

Features

- High-performance 16-bit CPU
- Register-to-register architecture
- On-chip memory (up to 32 Kbytes)
- Full complement of on-chip peripherals
- Event Processor Array (EPA) peripheral
- Peripheral Transaction Server (PTS) peripheral

Applications

- Anti-lock braking control
- Traction control
- Powertrain control
- Vehicle dynamics
- Injection/ignition/engine control
- Suspension control
- Steering systems

Benefits

- Ideal for high-speed event control
- No accumulator bottleneck
- Allows for single-chip designs
- High integration enables low-cost and low chip count designs
- Flexible and accurate timing and management of high-speed I/O events
- Faster I/O management with minimal CPU intervention and interrupt latency

Table 7-2. MCS® 96 Microcontroller Automotive Family Specifications

Product Name	Process	Bus Speed (ns)	Bus Codes (Bit)	Internal Memory			Timers/Counter		HSI Capture	HSO Compare
				EPROM/RAM	Register RAM	Code RAM	H/W	S/W		
8XC196CA	CHMOS	125	16K x 8	32K x 8	1K x 8	256 x 8	2	2	Up to 6	Up to 6
8XC196KT	CHMOS	125	16K x 8	32K x 8	1K x 8	512 x 8	2	2	Up to 10	Up to 10
8XC196JT	CHMOS	125	16K x 8	32K x 8	1K x 8	512 x 8	2	2	Up to 6	Up to 6
8XC196KS	CHMOS	125	16K x 8	24K x 8	1K x 8	256 x 8	2	2	Up to 10	Up to 10
8XC196KR	CHMOS	125	16K x 8	16K x 8	488 x 8	256 x 8	2	2	Up to 10	Up to 10
8XC196JR	CHMOS	125	16K x 8	16K x 8	488 x 8	256 x 8	2	2	Up to 6	Up to 6
8XC196KQ	CHMOS	125	16K x 8	12K x 8	360 x 8	128 x 8	2	2	Up to 10	Up to 10
8XC196JQ	CHMOS	125	16K x 8	12K x 8	360 x 8	128 x 8	2	2	Up to 6	Up to 6
8XC196KC	CHMOS	125	16K x 8	16K x 8	488 x 8	N/A	2	4	Up to 4	Up to 6
8XC196KB	CHMOS	167	16K x 8	8K x 8	232 x 8	N/A	2	4	Up to 4	Up to 6
8XC198	CHMOS	167	16K x 8	8K x 8	232 x 8	N/A	2	4	Up to 4	Up to 6
8XC194	CHMOS	167	8	8K x 8	232 x 8	N/A	2	4	Up to 4	Up to 6
8396JC	HMOS	250	16K x 8	12K x 8	232 x 8	128 x 8	2	4	Up to 4	Up to 6
8398JC	HMOS	250	8	12K x 8	232 x 8	128 x 8	2	4	Up to 4	Up to 3
8X96BH	HMOS	250	16K x 8	8K x 8	232 x 8	N/A	2	4	Up to 4	Up to 6

Table 7-2. MCS® 96 Microcontroller Automotive Family Specifications (Contd.)

Product Name	PWM Outputs	A/D Inputs	Interrupts Sources	I/O Lines	CAN Protocol	Serial Ports	Extra Features		Frequency Range Offered (MHz)	Package Types	
							WDT	PTS		Window	Plastic
8XC196CA	Up to 4	6	38	38	Yes	2	Yes	Yes	16	68-Pin CERQUAD	68-Pin PLCC
8XC196KT	Up to 4	8	37	56	No	2	Yes	Yes	16	68-Pin CERQUAD	68-Pin PLCC
8XC196JT	Up to 4	6	35	41	No	2	Yes	Yes	16	52-Pin CERQUAD	52-Pin PLCC
8XC196KS	Up to 4	8	37	56	No	2	Yes	Yes	16	68-Pin CERQUAD	68-Pin PLCC
8XC196KR	Up to 4	8	37	56	No	2	Yes	Yes	4-8/12/16	68-Pin CERQUAD	68-Pin PLCC
8XC196JR	Up to 4	6	35	41	No	2	Yes	Yes	4-8/12/16	52-Pin CERQUAD	52-Pin PLCC
8XC196KQ	Up to 4	8	37	56	No	2	Yes	Yes	4-8/12/16	68-Pin CERQUAD	68-Pin PLCC
8XC196JQ	Up to 4	6	35	41	No	2	Yes	Yes	4-8/12/16	52-Pin CERQUAD	52-Pin PLCC
8XC196KC	3	8	28	48	No	1	Yes	Yes	4-8/12/16	68-Pin CERQUAD	68-Pin PLCC
8XC196KB	1	8	28	48	No	1	Yes	No	3.5-8/12	N/A	68-Pin PLCC, PFP
8XC198	1	4	28	34	No	1	Yes	No	3.5-8/12	N/A	52-Pin PLCC
8XC194	1	0	28	34	No	1	Yes	No	3.5-8/12	N/A	52-Pin PLCC
8396JC	1	8	21	48	No	1	Yes	No	3.5-12	N/A	68-Pin PLCC, PFP
8398JC	1	6	21	34	No	1	Yes	No	3.5-12	N/A	52-Pin PLCC
8X96BH	1	8	21	48	No	1	Yes	No	3.5-12	68-Pin CERQUAD	68-Pin PLCC, PFP

8

PCMCIA Cards

CHAPTER 8
PCMCIA CARDS

8.1 ETHERNET* LAN CARD

The Intel PCMCIA Ethernet LAN card is the fastest, easiest way to deliver network-ready laptops to your customers. It snaps in and installs in minutes, not hours, thanks to a disk full of software to make your job easier. Intel's industry-standard SoftSet installation utility automatically configures the card and sets up the software with a single command. Built-in card management software performs IRQ management and allows the card to be installed even when the system is running, so you don't have to reboot. There's even built-in driver support for popular network operating systems from Novell, Microsoft, IBM and Banyan. There are no jumpers or switches to set, no IRQ address to labor over. The card's installed and working in five minutes. Once installed, it's easy to operate, too, improving customer satisfaction and decreasing the number of support calls you receive.

The card is fully PCMCIA 2.0/JEIDA 4.1 compliant with a standard 68-pin form factor. It's also fully compliant with the Ethernet IEEE 802.3 standard for 10BASE-T and 10BASE-2 wiring.

There's a detachable line adapter module (LAM) for attachment to multiple media and LEDs to indicate active and link integrity.

Features

- Complete plug-and-play PCMCIA LAN solution
- Built-in driver support for all major network operating systems
- Industry-recognized Intel SoftSet installation software
- Based on highly integrated Intel 82595 Ethernet controller
- Complies with PCMCIA 2.0/JEIDA 4.1 68-pin standard
- PCMCIA Type 2 card – 5.0 mm thick
- Detachable line adapter module (LAM) for multiple media attachment
- Activity and link integrity LEDs
- Ethernet IEEE 802.3 compatibility (10BASE-T/TPE, 10BASE-2/BNC)

Benefits

- Disk-based software makes installation fast and simple
- All drivers, installation, card and socket services and card management software are included to assure reliable operation
- Ease of operation means greater customer satisfaction

Applications

- Notebooks or PCs with PCMCIA slots

Table 8-1. LAN Card Specifications

Product Name	Speed	Package Type	#Pins	Order Code
Ethernet LAN Card	16-bit	PCMCIA Type 2 Ethernet 10BASE-T or 10BASE-2	68	MBLA8120 MBLA8110US

8.2 DATAFAX 14.4 CARD

The DataFax 14.4 combines high speed with an integrated DAA design to provide optimal connectivity for notebooks and sub-notebooks. PCMCIA cards enhance the multiple functionality of the notebook computer. Intel's integrated DAA incorporates the telephone interface circuitry directly onto the card. This includes a ring detector and telephone line coupling transformer. A six-foot cable connects the DataFax 14.4 card to a standard RJ-11 modular telephone jack for connectivity to the telephone network.

The DataFax 14.4 supports V.42 error correction, which ensures that errors caused by the phone system are automatically corrected. The DataFax 14.4 increases data throughput with V.42bis data compression. This detects redundant characters, character sequences, and uses fewer bits to send more frequently occurring sequences. DataFax 14.4 users enjoy an effective throughput of up to 57,600 bits per second.

Unlike other card manufacturers, Intel provides a full-service program for card labeling, custom kitting with third-party applications, and fulfillment. The Intel DataFax 14.4 is the only fax card designed with recessed covers to accept adhesive labels, front and back, ensuring quick turnaround for custom orders.

Features

- LAM-less design (integrated DAA)
- QuickSwap*-compatible
- Complies with PCMCIA 2.1 and JEIDA 4.1 standards
- PCMCIA Type 2 card – 5.0 mm thick
- Automatic power-down mode
- DTMF and PULSE dialing
- Fully compliant with CCITT T.30 and T.4 (Group 3 fax); CCITT V.17 (14.4 Kbps fax)
- Provides both Send and Receive fax capability
- 8-bit I/O bus interface
- Includes ring detect notification to host computer in power-down mode
- FCC Class B, UL and DOC/UL (Canada)
- Compatible with EIA/TIA 602 (AT* command set)
- Data modem complies with CCITT V.32bis, V.32, V.22bis, V.22, V.21, Bell* 212a, 103
- Supports CCITT V.42 error detection and V.42bis data compression
- Requires no external power
- Provides MNP/5* data compression for backward compatibility
- MNP/10
- Hayes AutoSync

Benefits

- No external circuitry; compact and lightweight
- Single slot serves multiple functions
- Provides high throughput (57.6 Kbps)
- Enhanced data throughput with cellular connections (required phone adapter)
- Provides synchronous communications capability (software required)

Applications

- Notebook computers

Table 8-2. DataFax 14.4 Card Specifications

Product Name	Speed	Package Type	#Pins	Order Code
DataFax 14.4 Card	14,400 bps Data 14,400 bps Fax	PCMCIA Type 2	68	INC230US

8.3 FAXMODEM 24/96 CARD

The Faxmodem 24/96 card provides convenient, high-performance mobile fax and data communications capabilities for the notebook computer user. Adherence to accepted national and international standards provides users with worldwide connectivity for both fax (approximately 30 million machines in use worldwide) and data transfer. Its exchangeability with other PCMCIA cards enhances the multiple functionality of the notebook computer.

The Faxmodem 24/96 contains the Intel 89C124FX integrated data-fax modem chip set, a UART, a microcontroller, an analog front end and other supporting devices. The 16450-type UART provides an 8-bit data bus interface. This, together with Class 1 AT command set support, provides compatibility with all major fax application software.

For U.S. and Canada, the Data Access Arrangement (DAA) is integrated on the card. Other countries use a detachable line adapter module, consisting of the ring detector and telephone line coupling transformer, incorporating country-specific telephone interface circuitry. A standard RJ-11 modular telephone jack provides connectivity to the telephone network. A short cable connects the line adapter module to the Faxmodem 24/96 card.

The Faxmodem 24/96 supports V.42 error correction, ensuring automatic correction of errors caused by the phone system. The Faxmodem 24/96 also supports V.42bis data compression. This increases data throughput by detecting redundant characters, character sequences, and using fewer bits to send frequently occurring sequences. Throughput for file transfer operations is increased by as much as 400 percent, providing the user with an effective 9600 bits per second.

Features

- Integrated DAA on the card for U.S./Canada
- Complies with PCMCIA 2.1 and JEIDA 4.1 standards
- PCMCIA Type 2 – 5 mm thick
- Fully compliant with CCITT T.30 and T.4 (Group 3 fax)
- Provides both Send and Receive fax capability
- Fully compliant with EIA/TIA 578 (Class 1 fax command set)
- Data modem complies with CCITT V.22bis, V.22, V.21, Bell 212a and 103
- Supports CCITT V.42 error detection and V.42bis data compression
- Provides MNP5 data compression for backward compatibility
- Includes ring detect notification to host computer in power-down mode
- Multiple power conservation modes
- Requires no external power

Benefits

- No external circuitry; compact and lightweight
- Single slot serves multiple functions
- Compatible with worldwide installed base of fax machines
- Compatible with standard communications packages
- Ensures connectivity worldwide
- Faster: up to 4-to-1 data compression providing an effective throughput of 9600 bits per second for file transfers

Applications

- Notebook computers

Table 8-3. Faxmodem 24/96 Card Specifications

Product Name	Speed	Package Type	#Pins	Order Code
Faxmodem 24/96	2400 bps Data 9600 bps Fax	PCMCIA Type 2	68	INC215US

9

Military and Special Products

CHAPTER 9
MILITARY AND SPECIAL PRODUCTS

Intel's Military and Special Division (MSPD) is chartered with bringing Intel's technologies to customers and markets not otherwise served by Intel. This includes customers who need commercial die and extended temperature products including microprocessors, microcontrollers, flash memories, EPROMs and PLDs, and avionics grade and military temperature-only products.

9.1 MILITARY AND EXTENDED TEMPERATURE MICROPROCESSOR ARCHITECTURES

MSPD supports the full line of Intel's 32-bit processor architectures: Intel386 SX/DX, Intel486 DX, i960 MC/XA and i860 XR CPUs. These are available in through-hole and surface-mount packages. Additionally, for the extended temperature market, there are microprocessors that address the needs of special applications—from portable and high-performance applications to rugged applications and severe environments. The Intel386 SX microprocessor, for example, is packaged in plastic making it ideal for portable applications. The typical temperature range for extended temperature products is −40°C to +110°C (case).

Features

- i960 microprocessor architecture (i960 MC and i960 XA CPUs):
  - RISC architecture for embedded applications
  - Well matched with Ada
  - JIAWG-standard architecture
- Intel386 and Intel486 microprocessor architectures (Intel386 SX/DX and Intel486 DX CPUs):
  - Compatible with large Intel architecture software base
  - Ada available from third-party vendors.
  - Intel486 DX processors qualified to Mil-Std-883 at 25 and 33 MHz
  - Intel386 DX and Intel486 DX CPUs especially well-suited for high-performance applications
  - Known good die
- i860 microprocessor family (i860 XR and i860 XP CPUs):
  - Parallel architecture with superior floating point
  - Ada available from third-party vendors
  - i860 XP processor targeted for known good die

Benefits

- Special packaging to meet the needs of military and extended temperature markets
- Integrated for cost-/space-sensitive applications
- Extended temperature design ideally suited for rugged and demanding applications

Applications

- Avionics/missiles; navigation
- GPS
- Communications
- Data terminals
- Radar/sonar, image processing
- Parallel processing

9.2 MILITARY MICROCONTROLLER PRODUCTS

Intel's Military and Special Product Division (MSPD) offers a line of 8-bit and 16-bit microcontrollers in through-hole and surface-mount packages. These parts are available in military temperature only and Mil-Std-883 versions.

Features

- MCS 51 microcontroller architecture (includes 87C51FB and 87C51FC):
  - Industry-standard 8-bit microcontroller architecture
  - Large I/O feature set
  - Separate 64-Kbyte code and data space
- MCS 96 microcontroller architecture (includes 80C196KB):
  - 16-bit CPU
  - 64-Kbyte total addressable memory space
  - Large peripheral I/O feature set
- 80186/C186 microcontroller architecture (includes 80C186EB and 80C186XL):
  - High integration 16-bit embedded processor architecture
  - Full 1-Mbyte memory and 64-Kbyte I/O addressing
  - Object code compatibility with all existing real mode Intel architecture software
  - Ada available from third-party vendors
  - Latest addition to the architecture is static core 80C186XL

Applications

- Missile and sub-munition guidance
- Engine control
- Communication
- GPS
- Data or event control

9.3 FLASH MEMORY ARCHITECTURE

Intel's flash memory products offer an easy, cost-effective way to alter code in an embedded system for military applications.

Features

- 1 Mbit (28F010):
  - 10K cycle parts
  - Flash electrical chip erase
  - CMOS low power consumption
  - ETOX™ II flash memory technology
- 2 Mbit (28F020):
  - JEDEC standard pinouts
  - Flash electrical chip erase
  - CMOS low power consumption
  - ETOX III flash memory technology
- 8 Mbit (28F008)
  - Deep power-down mode
  - Hardware data protection
  - 40-lead TSOP available
  - High-performance read

Benefits

- Embedded systems
- Nonvolatile mass storage arrays
- Remote networking
- Airborne and surface-based radars
- Electronic warfare suites
- Flight management simulations

Product Grades Available

- Mil-Std-883: −55°C to +125°C
- Military temperature only: −55°C to +125°C
- Avionics grade: −40°C to +125°C
- Extended temperature: −40°C to +110°C

9

9.4 DIE PRODUCTS

Any Intel product is a candidate for die sales. Please contact Intel for specific part availability.

Intel's Military and Special Products Division (MSPD) is expanding its product offering to adapt to customers' changing needs.

MSPD offers a select group of extended temperature, avionics grade and military temperature only products for OEMs looking to diversify into non-military applications and for customers faced with cost-sensitive designs. MSPD is committed to continue bringing Intel's latest commercial technologies to military OEMs.

To receive timely information on MSPD products, call the Intel literature center at 800-548-4725 and request a subscription to the *Military and Special Products* Newsletter (List 406).

Table 9-1. Military and Special Products Selection Guide — Processing Options

Product Name	Speed	Packaging Types				Description
		Mil-Std-883	Mil Temp Only	Avionics Temp	Extended Temp	
80486DX2	50, 66 MHz	MG, MQ (QML)	N/A	N/A	TA	32-bit w/clock doubler
80486DX	25, 33 MHz	MG/MQ	MG	N/A	TA	32-bit w/MMU
80386DX	16, 20, 25 MHz	MG/MQ	MG	N/A	TA	32-bit w/MMU
80386SX	16, 20 MHz	MG	MG	N/A	TA	16-/32-bit
80C186EB	8, 13, 16 MHz	MG	MG	N/A	N/A	Low power, static core
80C186XL	10, 12, 16, 20 MHz	MG	MG	N/A	N/A	C186 upgrade
80960XA	16, 20, 25 MHz	MG/MQ	N/A	N/A	N/A	JIAWG Std.
80960MC	16, 20, 25 MHz	MG/MQ	N/A	MG	N/A	32-bit integrated
80860XR	25, 33, 40 MHz	MG/MQ	N/A	N/A	N/A	32-/64-bit CPU
87C51FB	12, 16 MHz	MD/MR	N/A	N/A	N/A	16K EPROM
87C51FC	12, 16 MHz	MD/MR	N/A	N/A	N/A	32K EPROM
87C196KB	12 MHz	MG/MQ	MG	N/A	N/A	ROMless
87C196KC	16 MHz	MG/MQ	MG	N/A	N/A	16K EPROM

PACKAGES:
CK = Extended temp range, plastic QFP
TA = Extended temp range, ceramic PGA
TD = Extended temp range, ceramic DIP
MD = Military/avionics temp, ceramic DIP
MF = Military/avionics temp, ceramic Flatpack
MG = Military/avionics temp, ceramic PGA
MQ = Military/avionics temp, ceramic QFP
MR = Military temp range, ceramic LCC
MT = Military temp range, ceramic J-Lead
MZ = Miltary temp range, ceramic Gull-Wing

Table 9-2. Military Qualified Products List/Specifications

Product Name	Description	Speed	TH	SMT
EPROMs				
M2716M	2K x 8	450 ns	24-DIP	N/A
M2732A	4K x 8	250–450 ns	24-DIP	N/A
M27C64	8K x 8	200–350 ns	28-DIP	32-LCC
M27C128A	16K x 8	200–300 ns	28-DIP	N/A
M27C256	32K x 8	170–350 ns	28-DIP	32-LCC
M27C512	64K x 8	200–300 ns	28-DIP	N/A
M27C010	128K x 8	200–250 ns	32-DIP	N/A
M27C210	64K x 16	150–250 ns	40-DIP	44-LCC
M27C040	512K x 8	170–250 ns	32-DIP	N/A
Flash				
M28F010	128K x 8, 10K Cycle	99–250 ns	32-DIP	32-LCC 32-FP
M28F020	256K x 8, 10K Cycle	90–150 ns	32-DIP	32-FP
M28F008	1 Mbit x 8, 10K Cycle	100 ns	40-DIP	40-TSOP 42-FP
Static RAMs				
M2114A	1K x 4	150–250 ns	18-DIP	N/A
M2147H	4K x 1	45–85 ns	18-DIP	N/A
M2148H	1K x 4	55–70 ns	18-DIP	N/A
MCS® 48 Microcontroller Architecture				
M8035AHL	8-bit, ROMless CPU	11 MHz	40-DIP	N/A
M8048AH	8-bit, 1K ROM CPU	11 MHz	40-DIP	N/A
M7848H	8-bit, 1K EPROM CPU	11 MHz	40-DIP	N/A
MCS 51 Microcontroller Architecture				
M8031AH	8-bit, ROMless CPU	12 MHz	40-DIP	N/A
M8051AH	8-bit, 4K ROM CPU	12 MHz	40-DIP	N/A
M8751H	8-bit, 4K EPROM CPU	8 MHz	40-DIP	44-LCC
M80C31BH	8-bit, ROMless CPU	12 MHz	40-DIP	44-LCC
M80C51BH	8-bit, 4K ROM CPU	12 MHz	40-DIP	44-LCC
M87C51	8-bit, 4K EPROM CPU	12, 16 MHz	40-DIP	44-LCC
M80C51FB	8-bit, ROMless CPU	12,16 MHz	40-DIP	44-LCC
M87C51FB	8-bit, 16K EPROM CPU	12,16 MHz	40-DIP	44-LCC
M87C51FC	8-bit, 32K EPROM CPU	12, 16 MHz	40-DIP	44-LCC

Table 9-2. Military Qualified Products List/Specifications (Contd.)

Product Name	Description	Speed	TH	SMT
MCS 96 Microcontroller Architecture				
M8097BH	16-bit, ROMless, A/D CPU	12 MHz	68-PGA	68-QFP
M8397BH	16-bit, 8K ROM, A/D CPU	12 MHz	68-PGA	68-QFP
M8797BH	16-bit, 8K EPROM, A/D CPU	12 MHz	68-PGA	68-QFP
M80C196KB	16-bit, ROMless, A/D CPU	12 MHz	68-PGA	68-QFP
M87C196KC	16-bit, 16 EPROM, A/D CPU	16 MHz	68-PGA	68-QFP
8086 Microprocessor Architecture				
M8086	16-bit CPU	5,8 MHz	40-DIP	44-LCC
M80C86	16-bit CMOS CPU	5,8 MHz	40-DIP	N/A
M8088	8-/16-bit CPU	5 MHz	40-DIP	N/A
M8087	Math coprocessor	5,8 MHz	40-DIP	N/A
M82C84A	Clock generator	8 MHz	18-DIP	N/A
80186 Microprocessor Architecture				
M80186	Integrated 16-bit CPU	6,8 MHz	68-PGA	68-QFP
M80C186	Integrated 16-bit CMOS CPU	10,12 MHz	68-PGA	68-QFP
M80C186XL	Fully static C186 upgrade	10,12,16, 20 MHz	68-PGA	N/A
M80C186EB	Highly Integrated static 16-bit CPU	8,13,16 MHz	88-PGA	N/A
M80C187	Math coprocessor	10,12,16 MHz	40-DIP	68-QFP
M82188	Bus controller	8 MHz	28-DIP	N/A
80286 Microprocessor Architecture				
M80286	16-bit CPU w/MMU	6,8,10 MHz	68-PGA	68-QFP
M80C286	16-bit CMOS CPU w/MMU	10 MHz	68-PGA	68-QFP
M80287	Math coprocessor	6,8,10 MHz	40-DIP	N/A
M80C287	Math coprocessor	10 MHz	40-DIP	N/A
M82C284	Clock generator	6,8,10 MHz	18-DIP	N/A
M82C288	Bus controller	6,8,10 MHz	20-DIP	N/A
Intel386™ Microprocessor Architecture				
M80386DX	32-bit CPU w/MMU	16,20,25 MHz	132-PGA	164-QFP
M80386SX	16-/32-bit CPU w/MMU	16,20 MHz	88-PGA	N/A
M80387DX	Math coprocessor	16,20,25 MHz	68-PGA	68-QFP
M80387SX	Math coprocessor	16,20 MHz	68-PGA	N/A
M82370	Integrated peripheral for SX	16,20 MHz	132-PGA	N/A
M82380	Integrated peripheral for DX	16,20,25 MHz	132-PGA	164-QFP
Intel486™ Microprocessor Architecture				
M80486DX	32-bit CPU w/MMU & FPU	25,33 MHz	168-PGA	196-QFP
M80486DX2	32-bit CPU w/clock doubler	50, 66 MHz	168-PGA	196-QFP

Table 9-2. Military Qualified Products List/Specifications (Contd.)

Product Name	Description	Speed	TH	SMT
i960® Microprocessor Architecture				
M80960MC	Integrated 32-bit CPU	16,20,25 MHz	132-PGA	164-QFP
M80960XA	JIAWG standard ISA CPU	16,20,25 MHz	132-PGA	164-QFP
i860™ Microprocessor Architecture				
M80860XR	32-/64-bit CPU	25,33,40 MHz	168-PGA	196-QFP
8085 Microprocessor Architecture				
M8085	8-bit CPU	3 MHz	40-DIP	N/A
M8155H	2K SRAM, I/O, timer	3 MHz	40-DIP	N/A
Programmable Logic Devices				
M5C060	600 gate	55 ns	24-DIP	N/A
M5C090	900 gate	60 ns	40-DIP	N/A
M5C180	1800 gate	90 ns	68-PGA	68-QFP
M5AC312	Advanced logic replacement	30,35 ns	24-DIP	N/A
M85C220	20-Pin logic superset	50,66 MHz	20-DIP	N/A
M85C224	24-Pin logic superset	50,66 MHz	24-DIP	N/A
MiPLD610	5C060, EP610 upgrade	15,25,35 ns	24-DIP	N/A
MiPLD910	5C090, EP910 upgrade	20,25,30 ns	40-DIP	N/A
MiPLD22V10	22V10 μPLD	10,15,20 ns	24-DIP	N/A
Peripherals				
M8251A	USART	3 MHz	28-DIP	28-LCC
M8253	Programmable interval timer	2 MHz	24-DIP	N/A
M8254	Programmable interval timer	8 MHz	24-DIP	N/A
M8255A	Programmable peripheral interface	Static	40-DIP	N/A
M8259A	Programmable interrupt controller	Static	28-DIP	N/A
M8274	Multiprotocol serial controller	4 MHz	40-DIP	N/A
M8744H	Remote universal interface	10 MHz	40-DIP	N/A
M82510	ASYNC serial controller	288K baud	28-DIP	28-LCC
M82C54	Programmable interval timer	8 MHz	24-DIP	N/A
M82C55A	Programmable peripheral interface	Static	40-DIP	N/A
M82786	Graphics coprocessor	10 MHz	88-PGA	N/A
M82389	Message passing coprocessor	10 MHz	149-PGA	164-QFP
M82916	PI bus interface for 32-bit host	12.5 MHz		164-QFP

Table 9-3. Special Products List Extended Temperature Products/Specifications

Product Name	Description	Speed	TH	SMT
Intel386™ Microprocessor Architecture				
TA80386DX	32-bit CPU w/MMU	25 MHz	132-PGA	N/A
TA80386SX	16-/32-bit CPU w/MMU	20 MHz	88-PGA	N/A
CQ80386SX	16-/32-bit CPU w/MMU	20 MHz		100-PQFP
TA80387DX	Math coprocessor	25 MHz	68-PGA	N/A
TA80387SX	Math coprocessor	20 MHz	68-PGA	N/A
TA82370	Integrated peripheral for SX	20 MHz	132-PGA	N/A
TA82380	Integrated peripheral for DX	25 MHz	132-PGA	N/A
Intel486™ Microprocessor Architecture				
TA80486DX	32-bit CPU w/MMU & FPU	33 MHz	168-PGA	N/A
Flash				
TD28F010	128K x 8, 10K cycle	90 ns	32-DIP	N/A
TD28F020	256K × 8, 10K cycle	90 ns	32-DIP	N/A

Table 9-4. Avionics Grade Products/Specifications

Product Name	Description	Speed	TH	SMT
i960® Microprocessor Architecture				
80960MC	Integrated 32-bit CPU	16,20,25 MHz	132-PGA	164-QFP
Flash				
28F010	128K x 8, 10K cycle	90-250 ns	32-DIP	32-FP 32-LCC
28F020	256K x 8, 10K cycle	90-250 ns	32-DIP	32-FP
28F008	1M × 8, 10K cycle	95 ns	N/A	40-TSOP

Table 9-5. Military Temperature Only Products/Specifications

Product Name	Description	Speed	TH	SMT
Intel386™ Microprocessor Architecture				
M80386DX	32-bit CPU w/MMU	25 MHz	132-PGA	N/A
M80386SX	16-/32-bit CPU w/MMU	20 MHz	88-PGA	N/A
M80387DX	Math coprocessor	25 MHz	68-PGA	N/A
M80387SX	Math coprocessor	20 MHz	68-PGA	N/A
M82370	Integrated peripheral for SX	20 MHz	132-PGA	N/A
M82380	Integrated peripheral for DX	25 MHz	132-PGA	N/A
Intel486™ Microprocessor Architecture				
M80486DX	32-bit CPU w/MMU & FPU	33 MHz	168-PGA	N/A
80186 Microprocessor Architecture				
M80C186	Integrated, 16-bit CPU	12 MHz	68-PGA	N/A
M80C186XL	Fully static C186 upgrade	10, 12, 16, 20 MHz	68-PGA	N/A
M80C186EB	High integration static16-bit CPU	16 MHz	88-PGA	N/A
MCS® 96 Microcontroller Architecture				
M80C196KB	16-bit, ROMless, A/D, CPU	12 MHz	68-PGA	N/A
M87C196KC	16-bit, 16K EPROM, A/D, CPU	16 MHz	68-PGA	N/A

intel®

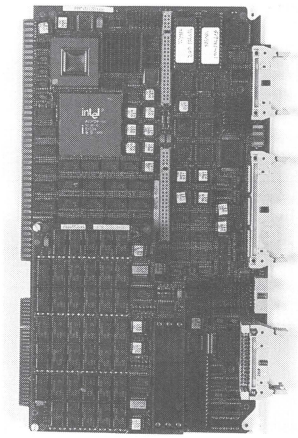
10

OEM Boards and Real-Time Operating Systems

CHAPTER 10
OEM BOARDS AND REAL-TIME OPERATING SYSTEMS

10.1 MULTIBUS I FAMILY

With 2.8 million installations worldwide, Multibus I is one of the most widely-used bus architectures in the world. This 16-bit, passive backplane architecture pioneered the use of microprocessors in embedded applications. Intel's Multibus I product line spans the Intel architecture, from 8-bit CPUs to Intel486 DX2 CPUs. A complete array of I/O and memory boards along with a variety of packaging options rounds out the product family. Intel's Multibus I family offers design protection through the on-going release of lower cost, higher performance, compatible single board computers.



Features

- Established, proven bus standard
- Passive backplane architecture
- Wide selection of Intel architecture CPUs available

Benefits

- Wide selection of functionality available
- Versatility in matching system resources to application requirements by adding or swapping boards
- Easy to migrate from one generation of silicon to the next with just a board change

Applications

- Machine control
- Process control
- Medical instrumentation
- Data acquisition
- Financial markets

Table 10-1. Multibus I Product Overview: CPU Boards: 8-Bit and 16-Bit

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied	iLBX Interface	ROM/EPROM Capacity Supplied (Bytes)	Serial Ports	Parallel I/O Lines	Timers	Interrupts	iSBX Connectors	Math/ Memory Expansion	Key Features
iSBC 80/10B	8080A	2.05	4 Kbyte/ 1 Kbyte	No	16 Kbyte/0	1 RS232C	48	1	1 level 11 sources	1	–	8080-based single-board computer
iSBC 80/24A	8085A-2	4.84	8 Kbyte/ 4 Kbyte	No	32 Kbyte/0	1 RS232C	48	3	12 levels 23 sources	2	iSBC 301	8085-based single-board computer
iSBC 86/05A	8086	5.0/8.0	16 Kbyte/ 8 Kbyte	No	256 Kbyte/0	1 RS232C	24	3	9 levels exp. to 65, 24 sources	2	iSBC 302A	Low-cost 8086-based single-board computer
iSBC 86/35A	8086	5.0/8.0	1 Mbyte/ 512 Kbyte	No	256 Kbyte/0	1 RS232C	24	3	9 levels 28 sources	2	8087	Newest 16-bit Multibus I single-board computer Replaces iSBC 86/35 and 86/30 Provides design protection for 8086-based designs
iSBC 86C/38	80C86	8.0	1 Mbyte/ 1 Mbyte	No	512 Kbyte/0	1 RS232C	24	3	9 levels 37 sources	2	iSBC 337A	Low-power, CMOS single-board computer
iSBC 88/25	8088	5.0	16 Kbyte/ 4 Kbyte	No	16 Kbyte/0	1 RS232C	24	3	9 levels 24 sources	2	iSBC 302A	Low-cost 8088-based single-board computer
iSBC 88/40A	8088	5.0	8 Kbyte/ 4 Kbyte	No	128 Kbyte	1 RS232C	24	3	9 levels 26 sources	2	iSBC 302A	Complete, 8088-based single-board computer
iSBC 186/03A	80186	8.0	64 Kbyte/0	Yes	256 Kbyte/0	2 RS232C or 1 RS232C + 1 RS422A	24 SCSI or general purpose	6	27	2	iSBC 341	80186-based single-board computer with configurable I/0 lines supporting SCSI
iSBC 286/10A	80286	8.0	128 Kbyte/0	Yes	512 Kbyte/0	2 RS232C or 1 RS232C + 1 RS422A	24	3	16 levels 26 sources	2	Intel287™ coprocessor iSBC 341	80286-based single-board computer with iLBX support
iSBC 286/12 286/14 286/16	80286	8.0	4 Mbyte/ 1 Mbyte 4 Mbyte/ 2 Mbyte 4 Mbyte/ 4 Mbyte	Yes	256 Kbyte/0	2 RS232C or 1 RS232C + 1 RS422A	24	3	16 levels 26 sources	2	Intel287 coprocessor 82258 ADMA iSBC 341	80286-based single-board computer. Compatible with SBC 386/12 and 486/12 board families

Table 10-2. Multibus I Product Overview: CPU Boards: 32-Bit

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied	iLBX Interface	ROM/EPROM Capacity Supplied (Bytes)	Serial Ports	Parallel I/O Lines	Timers	Interrupts	iSBX Connectors	Math/ Memory Expansion	Key Features
iSBC 386/21, 22, 24 or 28	i386	16	16 Mbyte/ 1,2,4, or 8 Mbyte	No	512 Kbyte/0	1 RS232C	0	3	16 levels, 26 sources	1	Intel387™ coprocessor, iSBC MM0XFP	Intel386™ CPU-based single-board computer
iSBC 386/12; 386/12S	i386	20	16 Mbyte/ 1,2,4, or 8 Mbyte	iLBX SCSI on S-models	512 Kbyte/0	2 RS232C or 1 RS232C + 1RS422A	24	3	16 levels, 26 sources	2	Intel387 coprocessor, 82258, iSBC MM0XFP	Intel386 CPU-based single-board computer with optional SCSI SBC 286/12 compatible
iSBC 386/31, 32, 34, or 38	i386	20	16 Mbyte/ 1,2,4, or 8 Mbyte	No	512 Kbyte/0	1 RS232C	0	3	16 levels, 26 sources	1	Intel387 coprocessor, iSBC MM0XFP	20-MHz version of iSBC 386/2X series
iSBC 486/12; 486/12S	i486 DX2	33	64 Mbyte/ 1,2,4, or 8 Mbyte	iLBX SCSI on S-models	512 Kbyte/0	2 RS232C or 1 RS232C + 1RS422A	24	3	16 levels, 26 sources	2	82258 on S models, iSBC MM30XX	Intel486™ CPU-based single-board computer with optional SCSI SBC 286/12 & 386/12 compatible
iSBC 486/12 DX2 486/12 DX2S	i486 DX2	66	64 Mbyte/ 1,2,4, or 8 Mbyte	iLBX SCSI on S-models	512 Kbyte/0	2 RS232C or 1 RS232C + 1RS422A	24	3	16 levels, 26 sources	2	82258, iSBC MM30XX	Highest performance, Multibus I single-board computer Intel486 DX2 CPU-based board with optional SCSI SBC 286/12 & 386/12 compatible

Table 10-3. Multibus I PC-Compatible CPU Boards

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied SIMMs	System Interfaces	Peripheral Controllers	Serial Ports	Parallel Port	Other I/O Ports	Optional Graphics Module	Other Features	Key Features
iSBC 386/SX	Intel386™ SX CPU	16	8 Mbyte/ 512 Kbyte or 2 Mbyte	Multibus 1	IDE Floppy	2 RS232C	Centronics-compatible	AT-style mouse, keyboard	Via iSBC 272: VGA, EGA, CGA, MDA, HGC	Interrupt controller, ADMA, two 32-pin EPROM sites, watchdog timer, real-time clock	Complete Intel386 SX CPU-based PC in a single Multibus slot, with on-board PC I/O & Multibus access for embedded use

Table 10-4. Multibus I Memory

Product Name	Memory Expansion	Access Time (ns)	386/2X 386/3X	386/12/ 12S	486/12/ 12S	486/12/12DX2
iSBC MM01FP	1 Mbyte RAM	85	Yes	Yes	N/A	N/A
iSBC MM02FP	2 Mbyte RAM	85	Yes	Yes	N/A	N/A
iSBC MM04FP	4 Mbyte RAM	85	Yes	Yes	N/A	N/A
iSBC MM08FP	8 Mbyte RAM	85	Yes	Yes	N/A	N/A
iSBC MM16FP	16 Mbyte RAM	85	Yes	Yes	N/A	N/A
iSBC MM3008	8 Mbyte RAM	70	N/A	N/A	Yes	Yes
iSBC MM3016	16 Mbyte RAM	70	N/A	N/A	Yes	Yes
iSBC MM3032	32 Mbyte RAM	70	N/A	N/A	Yes	Yes

Table 10-5. iSBC Memory Boards

Product Name	Memory Size (Bytes)	Address Range/Boundary	ECC or Parity	iLBX	Access Time (ns)	Supports Battery Backup	Features
iSBC 020CX	2 Mbyte	0–16 Mbyte/16 Mbyte boundary for Multibus access, 64 Kbyte boundary for iLBX access	ECC	Yes	380	Yes	2 Mbyte ECC memory board
iSBC 010 EX iSBC 020 EX iSBC 040 EX	1 Mbyte 2 Mbyte 4 Mbyte	0–16 Mbyte/256 Kbyte	Parity	Yes + Sync. interface	375 Multibus 295 iLBX 167 Sync	No	Parity memory boards for memory sharing and expansion

Table 10-6. EPROM Expansion Boards

Product Name	Memory Size (Bytes) Capacity/ Supplied	Memory Type	CPU Board Compatibility	Notes	Features
iSBC 341	256 Kbyte/0	EPROM SRAM	iSBC 86/05, 88/25, 88/40A, 88/45. 186/03A, 286/10A, 286/12/ 14/16	Mounts in existing baseboard EPROM/SRAM sockets	EPROM memory expansion for earlier CPU boards
iSBC 428	512 Kbyte/0 16 28-pin JEDEC sites	EPROM, ROM, E^2PROM, SRAM, NVRAM	All Multibus I and iLBX	Supports iLBX and Multibus access, 0 to 16 Mbyte address range on 4 Kbyte boundaries	512 Kbyte EPROM board
iSBC 429	4 Mbyte/0 32 32-pin JEDEC sites	Flash, memory, EPROM, Page Mode EPROM, ROM, E^2PROM, SRAM, static NVRAM	All Multibus I and iLBX	Supports iLBX and Multibus access, 0 to 16 Mbyte address range on 4 Kbyte boundaries	4 Mbyte general-purpose EPROM/Flash memory board

Table 10-7. Serial Communication Boards

Product Name	CPU	RAM	EPROM RAM	Serial I/O Ports	Protocol	Parallel I/O Lines	Interrupts	Timers	Key Features
iSBX 351	N/A	N/A	N/A	1 RS232C or RS422	Async/Sync	N/A	4 (to baseboard)	2	Single-channel serial add-on module
iSBX 354	N/A	N/A	N/A	2 RS232C or 1 RS232C + 1 RS422	HDLC/SDLC	N/A	4 (to baseboard)	N/A	Dual-channel serial add-on module
iSBC 534	N/A	N/A	N/A	4 TTY or RS232C	Async/Sync	16	16 levels 16 sources	2	Four channels of serial I/O
iSBC 544A	8085A	16-Kbyte (dual port) 256 static	8 Kbyte max.	4 RS232C	Async/Sync	10	12 levels 21 sources	3	8085-based, 4 channel serial I/O board
iSBC 548	80186	128 Dynamic (32 dual port)	64 Kbyte max.	8 RS232C	Async	N/A	8 levels	3	80186-based, 8-port terminal controller
iSBC 549	80186	128 Dynamic (32 dual port)	64 Kbyte max.	4 RS232C	Async	N/A	8 levels	3	80186-based, 4-port terminal controller
iSBC 88/45	8088 8 MHz	16 Kbyte	128 Kbyte max.	3 RS232C/ RS422A	HDLC/SDLC Async/Sync on 2	2	9 levels 23 sources	2	8088-based, 3-channel comm board
iSBC 188/56	80188 8 MHz	256 Kbyte/ 256 Kbyte (48 Kbyte dual port)	192 Kbyte max.	8 RS232C or 6 RS422C + 2RS422A	Async/Sync HDLC/SDLC	N/A	22 levels 59 sources	6	80188-based, 8-channel comm board

Table 10-8. Multibus I Serial Communication Boards

Product Name	CPU	RAM	EPROM RAM	Serial I/O Ports	Protocol	Parallel I/O Lines	Interrupts	Timers	Key Features
iSBC 186/51	80186 8 MHz	256 Kbyte/ 128 Kbyte	192 Kbyte/0	1 Ethernet* 2 RS232C or RS422A	IEEE 802.3 Async, Sync	9 levels 28 sources	3	N/A	80186-based, Ethernet controller and comm. board
iSBC/iSXM 552A	80186 8 MHz	256 Kbyte/ 256 Kbyte	128 Kbyte/0	1 Ethernet	IEEE 802.3	N/A	N/A	N/A	80186-based, Ethernet controller board
iSBX 586	82586	16 Kbyte/ 16 Kbyte	N/A	1 Ethernet	IEEE 802.3	N/A	N/A	Requires 16-bit iSBX slot	Ethernet interface add-on module

*Other brands and names are the property of their respective owners.

Table 10-9. Multibus I Parallel I/O Boards

Product Name	RAM	EPROM ROM	Serial I/O Ports	Parallel I/O Lines	iSBX Connectors	Interrupts	Key Features
iSBX 350	N/A	N/A	N/A	24 programmable	0	3	Digital I/O add-on module
iSBC 519A	N/A	N/A	N/A	72 programmable	3	8 levels 10 sources	72-line, parallel I/O board
iSBC 556	N/A	N/A	N/A	24 in + 16 out + 8 programmable	0	2 levels 8 sources	Optical isolated I/O board with 24 in, 16 out, 8 programmable I/O
iSBC 569	2-Kbyte dual port	16 Kbyte	1	54 (3 UPI-41As)	0	12 levels 22 sources	54-line, parallel I/O board

Table 10-10. Multibus I Peripheral Controllers: Flexible Disk, Winchester, SMD Tape

Product Name	System Interface	Floppy Interface	Disk Interface	Tape Interface	Key Features
iSBC 208	Multibus I	SA 450, SA 460 (4 drives)	ST 506, ST 412 (4 drives)	QIC-02 (4 drives)	General-purpose peripheral controller
iSBX 218A	iSBX	SA 450, SA 460 (4 drives)	N/A	N/A	Add-on peripheral controller module
iSBC 221	Multibus I	SA 45X, SA 46X, 475	ESDI, ST 506, ST 412	QIC-02	General-purpose peripheral controller, including ESDI and ST506 hard disks

Table 10-11. Multibus I Analog I/O Boards

Product Name	Size	Analog Input	Analog Output	Differential Input	Current Output	Voltage Output	Key Features
iSBX 311	Single-wide	16	N/A	8	N/A	N/A	Add-on analog input module
iSBX 328	Single-wide	N/A	8	N/A	1	Uni or Bipolar	Add-on analog output module

Table 10-12. Multibus I Graphics Boards

Product Name	Screen Resolution	Color or B/W	Frame Rate	Pixel Clock	CRT Interface	Key Features
iSBX 279A	640 x 480	256 colors	60 Hz, 31.5 Hz	25 MHz	NEC MultiSync*	Add-on graphics display controller

*Other brands and names are the property of their respective owners.

Table 10-13. Multibus I Math Module

Product Name	Math Coprocessor	Speed (MHz)	Interrupts	Compatible Boards	Key Features
iSBC 337A	8087	5	1	iSBC 86/05A, 88/25, 88/40A	Adds math coprocessor

Table 10-14. Multibus I Support Products

Product Name	Key Features
iSBX 488	Add-on GPIB controller module, single-wide

Table 10-15. Multibus I Chassis

Product Name	Board Capacity	Peripheral Bays	Output Power (Watts)	Multiprocessor Capability	Key Features
B320E	7	3 full-height	435	1-7 Bus masters, using bus arbitration	Complete system chassis with 7 Multibus slots and 3 peripheral bays

Table 10-16. Multibus I Cardcages

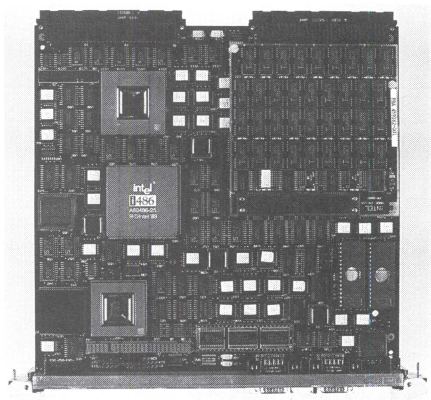
Product Name	Number of Slots	Teminators	Slot Spacing	Key Features
iSBC 604	4	Included	4 x 0.6 inch	4-slot cardcage
iSBC 614	4	Not required	4 x 0.6 inch	4-slot cardcage with card-cage interconnect connector
iSBC 608	8	Included	6 x 0.8 inch; 2 x 1.2 inch	8-slot cardcage
iSBC 618	8	Not required	6 x 0.8 inch; 2 x 1.2 inch	8-slot cardcage with card-cage interconnect connector

Table 10-17. Multibus I Software Compatibility

Product Name	iRMX® I.8 Operating System	iRMX III.2 Operating System	DOS	iRMX for Windows Operating System	iRMX for PCs Operating System
CPU Boards					
iSBC 86/05A	Yes				
iSBC 86/35A	Yes				
iSBC 86C/38	Yes				
iSBC 186/03A	Yes				
iSBC 286/10A	Yes				
iSBC 286/12	Yes				
iSBC 386/2x/3x	Yes	Yes			
iSBC 386/12/12S	Yes	Yes			
iSBC 486/12/12S	Yes	Yes			
iSBC 486/12DX2	Yes	Yes			
PC-Compatible CPU Boards: iSBC 386SX			Yes	Yes	Yes
Peripheral Controllers					
iSBC 208	I/O	I/O			
iSBC 218A	I/O	I/O			
iSBC 221	I/O	I/O			
Serial I/O					
iSBC 188/56	I/O	I/O			
iSBC 534, 544A	I/O	I/O			
iSBC 88/45	I/O	I/O			
iSBC 548/549	I/O	I/O			
Networking					
iSBC 552A	I/O	I/O			
iSBC 186/51	Yes / I/O	I/O			

Y = Runs on
I/O = Supported for I/O

10.2 MULTIBUS II FAMILY



The Multibus II product family, with its 32-bit distributed multi-processing architecture, is the bus of choice for demanding high-performance applications. Its passive backplane architecture allows for flexibility in matching system resources to application requirements. Multibus II's message-passing architecture and bandwidth provide high throughput and lets users create flexible products that are easily scalable: single or multiple CPU systems, using intelligent or non-intelligent I/O.

Continuous product evolution and improvement lets users readily apply the latest Intel architecture to create systems with many times the power of even the fastest PC or network of PCs. Recent additions to Intel's Multibus II product family include a selection of PC-compatible single board computers and the popular MIX modular I/O architecture.

Features

- Wide selection of Intel architecture CPUs available
- Supports multiple operating systems
- 40-Mbyte/second burst mode
- 256 individual interrupts

Applications

- Telecommunications
- Data acquisition
- Image processing
- Industrial automation
- Financial systems

Benefits

- Can easily migrate from one generation of silicon to the next with just a board change
- Runs heterogeneous operating systems
- Superb performance to handle the most demanding applications
- Can build large, I/O-intensive applications with guaranteed response times

Table 10-18. Multibus II CPU Boards: 32-Bit

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied	High Speed Interfaces	ROM/EPROM Capacity Supplied	Serial I/O Ports	Timers	Interrupts	iSBX Connectors	Expansion	Key Features
iSBC 386/120	Intel386™ CPU	20.0	16 Mbyte/ 1 Mbyte, 2 Mbyte, 4 Mbyte, 8 Mbyte	N/A	512 Kbyte/ 128 Kbyte	1 RS232C	3	15 levels, 255 sources	1	iSBC MM0XFP	Low-cost 32-bit CPU at 20 MHz
iSBC 386/133	Intel386 CPU	33.0	32 Mbyte/ 1 Mbyte, 2 Mbyte, 4 Mbyte, 8 Mbyte	iLBX II	512 Kbyte/ 256 Kbyte	1 RS232C	3	5 levels, 255 sources	1	iSBC MM0XFP	32-bit CPU at 33 MHz plus iLBX II interface
iSBC 486/125	Intel486™ DX CPU	25.0	64 Mbyte/ 8 Mbyte or 32 Mbyte	iLBX II	512 Kbyte/ 256 Kbyte	1 RS232C	3	5 levels, 255 sources	1	iSBC MM0XFC	Intel486 CPU-based single-board computer, with 25 MHz Intel486 CPU, on-chip cache, coprocessing and up to 64-Mbyte DRAM
iSBC 486/133SE	Intel486 DX CPU	33.0	64 Mbyte/ 8 Mbyte, 16 Mbyte, or 32 Mbyte	SCSI Ethernet*	512 Kbyte/ 256 Kbyte	1 RS232C	3	5 levels, 255 sources	1	iSBC MM30XX	High-integration, Intel486 CPU-based single-board computer with on-board SCSI and Ethernet
iSBC 486/150	Intel486 DX2 CPU	50.0	64 Mbyte/ 8 Mbyte or 32 Mbyte	iLBX II	512 Kbyte/ 256 Kbyte	1 RS232C	3	5 levels, 255 sources	1	iSBC MM0XFC	High-compute performance, with 50-MHz Intel486 DX2 CPU and up to 64-Mbyte DRAM
iSBC 486/ 166SE	Intel486 DX2 CPU	66.0	64 Mbyte/ 8 Mbyte, 16 Mbyte, or 32 Mbyte	SCSI Ethernet	512 Kbyte/ 256 Kbyte	1 RS232C	3	5 levels, 255 sources	1	iSBC MM30XX	High integration, highest CPU performance with 66-MHz Intel486 DX2 CPU, plus on-board SCSI and Ethernet

*Other brands and names are the property of their respective owners.

Table 10-19. MIX Baseboard: 32-Bit

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied	High-Speed Interfaces	I/O Ports	Expansion	Other Features	Key Features
MIX 386/020A	Intel386™ CPU	20.0	66 Mbyte/ 4 Mbyte	MIX	On modules	MIX modules	82258 ADMA	Lowest-cost MIX baseboard
MIX 486/020A	Intel486™ DX CPU	20.0	66 Mbyte/ 4 Mbyte	MIX	On modules	MIX modules	82258 ADMA	Intel486 CPU-based MIX baseboard
MIX 486/SX33	Intel486 SX CPU	33.0	32 Mbyte/ 0 Mbyte or 8 Mbyte via SIMMs	MIX	On modules	MIX modules	82258 ADMA 128 Kbyte L2 cache	Entry-level, upgradable MIX baseboard with highest I/O performance
MIX 486/DX33	Intel486 DX CPU	33.0	32 Mbyte/ 0 Mbyte or 8 Mbyte via SIMMs	MIX	On modules	MIX modules	82258 ADMA 128 Kbyte L2 cache	Mid-range, upgradable MIX baseboard with highest I/O performance
MIX 486/DX 66	Intel486 DX2 CPU	66.0	32 Mbyte/ 0 Mbyte or 8 Mbyte via SIMMs	MIX	On modules	MIX modules	82258 ADMA 128 Kbyte L2 cache	Highest performance MIX baseboard with highest I/O performance

NOTE:
All baseboards accept up to 3 MIX modules for expandable I/O

Table 10-20. Multibus II Baseboard/Memory Board Capability

Product Name	Expansion	Access Time (ns)	386/120 386/133	486/125 486/150	486/133SE 486/166SE	MIX 386/020A MIX 486/020A
iSBC MM01FP	1 Mbyte RAM	85	Yes	No	No	No
iSBC MM02FP	2 Mbyte RAM	85	Yes	No	No	No
iSBC MM04FP	4 Mbyte RAM	85	Yes	No	No	No
iSBC MM08FP	8 Mbyte RAM	85	Yes	No	No	Yes
iSBC MM16FP	16 Mbyte RAM	85	Yes	No	No	Yes
iSBC MM32FP	32 Mbyte RAM	85	Yes	No	No	Yes
iSBC MM08FC	8 Mbyte RAM	70	No	Yes	No	No
iSBC MM32FC	32 Mbyte RAM	70	No	Yes	No	No
iSBC MM3008	8 Mbyte RAM	70	No	No	Yes	No
iSBC MM3016	16 Mbyte RAM	70	No	No	Yes	No
iSBC MM3032	32 Mbyte RAM	70	No	No	Yes	No

Table 10-21. Multibus II PC-Compatible CPU Boards

Product Name	CPU	Clock Rate (MHz)	RAM Capacity Supplied (70 ns SIMMs)	System Interfaces	Peripheral Control	Serial Ports	Parallel Ports	Other I/O Ports	Optional Graphics Module	Other Expansion Available	Key Features
iSBC 486 SX/25	Intel486™ SX CPU	25	32 Mbyte/0	Multibus II P2/aPC (ISA)	SCSI IDE Floppy	2 RS232C	Centronics-compatible	AT*-style mouse, keyboard	SVGA, VGA, EGA, CGA, MDA, HTGC	IDE or SCS back-planes, Ethernet* module	Complete Intel486 SX CPU-based PC in a single Multibus II slot Extensive I/O options
iSBC 486 DX/33	Intel486 DX CPU	33	32 Mbyte/0	Multibus II P2/aPC (ISA)	SCSI IDE Floppy	2 RS232C	Centronics-compatible	AT-style mouse, keyboard	SVGA, VGA, EGA, CGA, MDA, HTGC	IDE or SCSI back-planes, Ethernet module	Complete 33-MHz, Intel486 CPU-based PC in a single Multibus II slot Extensive I/O options
iSBC 486 DX/66	Intel486 DX2 CPU	66	32 Mbyte/0	Multibus II P2/aPC (ISA)	SCSI IDE Floppy	2 RS232C	Centronics-compatible	AT-style mouse, keyboard	SVGA, VGA, EGA, CGA, MDA, HTGC	IDE or SCSI back-planes, Ethernet module	High-performance, 66-MHz, Intel486 CPU-based PC in a single Multibus II slot Extensive I/O options

*Other brands and names are the property of their respective owners.

Table 10-22. Multibus II Memory Boards

Product Name	Memory Size (Bytes)	Address Range/Boundary	ECC or Parity	iLBX	Access Time (ns)	Supports Battery Backup	Key Features
iSBC MEM/128	128 Mbyte	0–4 Gbyte/1Mbyte	Parity	No	200	No	Standalone Multibus II memory board for expansion or memory-sharing

Table 10-23. Terminal Controllers

Product Name	CPU	RAM	EPROM ROM	Serial I/O Ports	Protocol	Interrupts	Timers	Key Features
iSBX 351	N/A	N/A	N/A	1 RS232C or RS422	Async/Sync	4 (to baseboard)	2	Single-channel serial add-on module
iSBX 354	N/A	N/A	N/A	2 RS232C or 1 RS232C + 1 RS422	HDLC/SDLC	4 (to baseboard)	N/A	Dual-channel serial add-on module
iSBC 186/450	80186 8 MHz	512 K	Two 32-pin	12 RS232C 110 19.2 kbaud	Async	5	N/A	80186-based, 12-port terminal controller
MIX 450	On base	On base	On base	12 to 36 RS232C 110 19.2 kbaud	Async	On base	On base	Stackable, MIX terminal controller module with 12 ports per module

Table 10-24. Wide Area Network Controllers

Product Name	CPU	RAM (Bytes)	EPROM ROM	Serial I/O Ports	Protocol	Interrupts	Timers	Key Features
iSBC 186/410	80186 8 MHz	512 Kbyte/ 256 Kbyte	256 Kbyte/0	6 RS232C or 4 RS422C + 2 RS422A	Async/Sync HDLC/SDLC	16 levels 15 sources	3	80186-based, 6-channel comm. board
MIX 420	On base	On base	Base plus two 32-pin sites	2 to 6 RS422 110 64 kbaud	Sync	On base	3	Stackable, MIX comm module with 2 high-speed channels per module

Table 10-25. Multibus II Local Area Network Controllers

Product Name	CPU	RAM (Bytes)	EPROM ROM	Serial I/O Ports	Protocol	Interrupts	Timers	Key Features
iSBC 186/530	80186 8 MHz	512 Kbyte/ 512 Kbyte	256 Kbyte/0	1 Ethernet* 1 RS232C	IEEE 802.3 Async	5 levels 5 sources	3	80186-based, Ethernet comm. engine
MIX 560	On base	Base plus 64 Kbyte	Base plus two 32-pin sites	1 Ethernet 1 Ethernet serial 1 RS232C	IEEE 802.3	Base plus 14	Base plus 3	Stackable, MIX Ethernet controller module
iSBC EWENET (for PC compatibles)	On base	On base	Base plus one 32-pin site	1 Ethernet	IEEE 802.3	Base plus 2	On base	Ethernet controller module for PC-compatible CPU boards

*Other brands and names are the property of their respective owners.

Table 10-26. Multibus II Parallel I/O Boards

Product Name	Parallel I/O Lines	Interrupts	Key Features
iSBX 350	24 programmable	3	Digital I/O add-on module
iSBC MPI 519	72 programmable	8 levels 10 sources	72-parallel channels of TTL-level I/O in Multibus II I/O space

Table 10-27. Multibus II Peripheral Controllers: Flexible Disk, Winchester, SMD, Tape

Product Name	System Interface	Floppy Interface	Disk Interface	Tape Interface	Notes	Key Features
iSBC 386/258S	Multibus II	SCSI	SCSI	SCSI	SCSI single-ended	Intel386™ CPU-based SCSI controller
iSBC 386/258D	Multibus II	SCSI dual	SCSI dual	SCSI dual	Dual SCSI: single-ended and differential	Intel386 CPU-based SCSI controller

Table 10-28. Multibus II Analog I/O Boards

Product Name	Size	Analog Input	Analog Output	Differential Input	Current Output	Voltage Output	Product Description
iSBX 311	Single-wide	16	N/A	8	N/A	N/A	Add-on analog input module
iSBX 328	Single-wide	N/A	8	N/A	1	Uni or bipolar	Add-on analog output module

Table 10-29. Multibus II Graphics Boards

Product Name	Screen	Color or B/W	Frame Rate	Pixel Clock	CRT Interface	Product Description
iSBX 279A	640 x 480	256 colors	60 Hz, 31.5 Hz	25 MHz	NEC MultiSync*	Add-on graphics display controller

*Other brands and names are the property of their respective owners.

Table 10-30. Multibus II Support Products

Product Name	Product Description
iSBX 488	Add-on GPIB controller module, single-wide
CSM 001	Central Services Module, full-size Multibus II board
CSM 002	Central Services Module, baseboard add-on module

Table 10-31. Multibus II Chassis

Product Name	Board Capacity	Peripheral Bays	Output Power (Watts)	Multiprocessor Capability	Notes	Key Features
CH 541	20	0	750	Y	Rackmount	20-slot powered chassis
CH 542R	0	3 full-height	300	N/A	Rackmount	Rackmount peripheral chassis
SYP 520	8	3 full-height	535	Y	Floor or table	Complete system chassis with 8 Multibus II slots and 3 peripheral bays

Table 10-32. Multibus II Software Compatibility

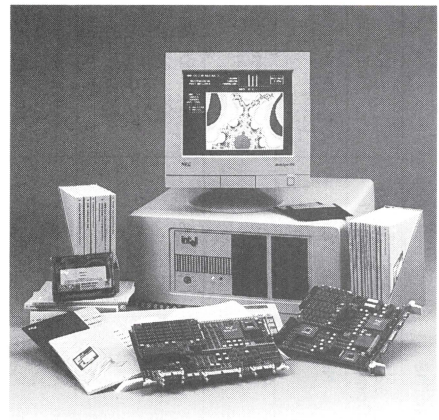
Product Name	iRMX® I.8 Operating System	iRMX III.2 Operating System	DOS	iRMX for Windows Operating System	iRMX for PCs Operating System
CPU Boards					
iSBC 386/120	Yes	Yes			
iSBC 386/133	Yes	Yes			
iSBC 486/125	Yes	Yes			
iSBC 486/133SE	Yes	Yes			
iSBC 486/150	Yes	Yes			
iSBC 486/166SE	Yes	Yes			
MIX 486/020	Yes	Yes/I/O			
MIX 486/DX		Yes/I/O			
PC-compatible CPU Boards					
iSBC 486SX/25			Yes	Yes	Yes
iSBC 486DX/33			Yes	Yes	Yes
iSBC 486DX/66			Yes	Yes	Yes
Peripheral Controllers					
iSBC 386/258D	Yes/I/O	I/O		I/O	I/O
iSBC 386/258S	Yes/I/O	I/O		I/O	I/O
Terminal Controllers					
iSBC 186/450	I/O	I/O		I/O	I/O
MIX 450	I/O	I/O		I/O	I/O
Serial I/O					
iSBC 186/410	I/O	I/O		I/O	I/O
MIX 420	I/O	I/O		I/O	I/O
Networking					
iSBC 186/530	I/O	I/O		I/O	I/O
MIX 560	I/O	I/O		I/O	I/O

Y = Runs on
I/O = Supported for I/O

10.3 iRMX® III OPERATING SYSTEM FAMILY

The 32-bit iRMX III family of real-time operating systems enables the design of highly reliable, real-time applications for Intel386, Intel486, and Pentium microprocessor-based systems. These include embedded, Multibus I, Multibus II, and PC-compatible (both MS-DOS and Microsoft Windows) computers.

The iRMX III operating systems offer a broad range of functions and features that provide an excellent foundation for time-critical, event-driven asynchronous applications.



Features

- 32-bit architecture
- Object-oriented architecture; interrupt-driven, pre-emptive, priority-based scheduling
- Dynamic allocation
- Layered architecture
- Support for wide range of standard input, output and mass storage devices
- Run-time binding
- Third-party MS-DOS-based tools support: Microsoft C and C++ V7.0, Watcom C/386 V9.0 and C++/386 V1.0, Borland C and C++, and Metaware high C/C++* for use in linking and compiling iRMX software applications
- iRMX III and iRMX for PCs operating systems can be ROMed

Benefits

- Enables 4-Gbyte addressing and rapid 32-bit arithmetic and logic operations
- Simplifies application design and programming
- Ensures predictable response to external events
- Allows effective use of available memory by all jobs
- Can configure only those parts of the operating system needed
- Eliminates the need to link application code to operating system code
- Enables designer to use tools of choice for application development
- Enables design of diskless, stand-alone system

Applications

- Machine tool control
- Flight simulators
- Automated teller machine communication
- Medical imaging – MRIs, X-rays, CAT scanners
- Digital switches for cellular phones

Table 10-33. iRMX® Real-Time Operating Systems

Product Name	Architecture	Task Control	Interactive Configuration	Bootstrap Loader	ROM Support	Support DDE	Object Oriented	On-Line Help	32-Bit Compilers	Networking Support	Key Features
iRMX® I operating system	16-bit Multibus U, Multibus II	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	The original complete, real-time O.S.
iRMX III operating system	32-bit Multibus I, Multibus II	Yes	Yes	Yes	Yes	No	Yes	Intel and TPV	Yes	Yes	Complete, 32-bit, real-time O.S.
iRMX for Windows operating system	32-bit PC AT, PC compatible CPU boards on Multibus I or Multibus II	Yes	No	No	Yes	Yes	Yes	Intel and TPV	Yes	Yes	iRMX III for Windows operating system environments. Supports DOS/Windows* as a task
iRMX for PCs operating system	32-bit PC AT*, PC compatible CPU boards on Multibus I or Multibus II	Yes	No	Yes	Yes	Yes	Yes	Intel and TPV	Yes	Yes	Provides real-time O.S. for PCs, without needing DOS or Windows
iRMX EMB operating system	32-bit Embedded	Yes	Yes	No	Yes	Yes	No	Intel and TPV	TBD	No	A nucleus/kernal version of the iRMX Operating System for embedded designs

NOTE:
TPV = Third Party Vendor

*Other brands and names are the property of their respective owners.

11

OEM Platform Products

CHAPTER 11
OEM PLATFORM PRODUCTS

11.1 CLASSIC EXPANDABLE PLATFORM AND BOARD FAMILY

The Intel486 microprocessor-based Classic Family offers an affordable solution to the OEM or custom solution provider seeking maximum flexibility and expandability in affordable packages. All feature the Intel486 processor with OverDrive sockets for future growth. They all come standard with 4 Mbytes of memory, expandable to as much as 128 Mbytes. Standard I/O functions are integrated on the motherboard, leaving more slots available for OEM use. Classic platforms and baseboards are an excellent way to cost-effectively meet today's needs while designing in future flexibility.

Features

- OverDrive processor sockets for instant upgradability
- 4-Mbyte memory expandable to as much as 128 Mbytes
- Integrated local bus graphics (512-Kbyte standard)
- 3-7 ISA or PCI expansion slots and/or 1 VESA local bus slot
- 4-5 peripherals bays
- Integrated IDE and floppy controller

Benefits

- High performance with reduced power consumption
- Configuration flexibility to address current and future needs
- Excellent price/performance ratio
- Expandability for future processor upgrades
- Outstanding graphics/Windows performance

Applications

- Low-cost Windows workstations
- Industry-standard "slots and watts" applications
- Embedded applications

Table 11-1a. Intel Classic Series Overview

Product Name	Chassis	Bus	CPU/ Speeds	Performance Upgrades	Intel486™ CPU	Pentium™ Architecture	Cache
R-Series Platforms	Low-profile Desktop	ISA	Intel486 SX/25, SX/33, DX/33, DX2/66 CPU	OverDrive™ processors	50/66 MHz	Yes	Optional
E-Series Platforms	Expandable Desktop	ISA/VL	Intel486 SX/25, DX/33 CPU	OverDrive processors	50/66 MHz	Yes	Optional
PCI Baby-AT	Expandable Desktop	PCI	Intel486 SX/33, DX/33, DX2/66 CPU	OverDrive processors	33/66 MHz	Yes	128 Kbyte

Table 11-1b. Intel Classic Series Overview (Contd.)

Product Name	Memory		Peripheral Bays	Slots				
	Standard	Maximum		Total	VL-Bus	EISA	ISA 16-Bit	ISA 8-Bit
R-Series Platforms	4 Mbyte	32 Mbyte	4	3 or 5	None	None	3 or 5	None
E-Series Platforms	4 Mbyte	64 Mbyte	5	7	1	None	7	None
PCI Baby-AT	8 Mbyte	128 Mbyte	5	7	None	2 Dedicated PCI	4 Dedicated ISA	1 Shared PCI-ISA

Table 11-1c. Intel Classic Series Overview (Contd.)

Product Name	Ports			Power Supply	Video	Standard Video Memory	Maximum Resolution	Other
	Mouse	Serial	Parallel					
R-Series Platforms	1	2	1	145W	Local bus graphics	512 Kbyte	1024 x 768	Power management
E-Series Platforms	None	2	1	200W	None	None	None	Multi I/O card
PCI Baby-AT	None	2	1	200W	None	None	None	None

11.2 PROFESSIONAL DESKTOP FAMILY

The Intel Professional Workstation and the Professional/GX feature exceptionally high integration, network readiness, and a snap-apart chassis. They are optimized for networked office environments, with local bus LAN implementation of Intel's 32-bit Ethernet technology. The LAN and 32-bit SCSI controllers are integrated right on the baseboard, leaving plenty of expansion room, and the sleek, low-profile chassis provides surprising flexibility. Both models make a compact, cost-effective server in UNIX and Novell environments. Or, use them as graphics workstations with all the flexibility of a PC.

Features

- Intel486 SX/25, DX/33, DX2/50 or DX2/66 CPU
- Integrated 32-bit Ethernet (TP or AUI)
- Integrated 32-bit SCSI for external expansion
- Two 32-bit EISA/ISA expansion slots
- Fast local bus accelerated graphics
- Memory expandable to 128 Mbytes
- Integrated IDE and floppy controller
- Integrated 16-bit digital stereo supporting sampling rates to 48 KHz
- High and standard resolution graphics

Benefits

- Exceptionally high integration capabilities
- Highly flexible, snap-apart chassis for easy integration
- Network-ready

Applications

- Networked client workstations
- Cost-effective servers
- Workstations for graphics-intensive CAD, UNIX, NeXTstep, and multimedia applications

Table 11-2a. Intel Professional Desktop Family Specifications

Product Name	Chassis	Bus	CPU/ Speeds	Performance Upgrades	Intel486™ CPU	Pentium™ Architecture	Cache
Professional/GX High Resolution	Low-profile snap-together	EISA/ISA	DX2/66	OverDrive™ processors	66 MHz	Yes	64 Kbyte on DX2/66; optional on others
Professional/GX Standard Resolution	Low-profile snap-together	EISA/ISA	DX/33	OverDrive processors	66 MHz	Yes	64 Kbyte on DX2/66; optional on others
Professional Workstation	Low-profile snap-together	EISA	DX/33	Intel487™ coprocessors	No	No	64/128 optional

Table 11-2b. Intel Professional Desktop Family Specifications (Contd.)

Product Name	Memory		Peripheral Bays	Slots		
	Standard	Maximum		Total	EISA	ISA 16 Bit
Professional/GX High Resolution	8 Mbyte	128 Mbyte	2	3	2	1
Professional/GX Standard Resolution	4 Mbyte	128 Mbyte	2	3	2	1
Professional Workstation	4 Mbyte	128 Mbyte	2	2	2	None

Table 11-2c. Intel Professional Desktop Family Specifications (Contd.)

Product Name	Ports			Power Supply	Video	Standard Video Memory	Maximum Resolution
	Mouse	Serial	Parallel				
Professional/GX High Resolution	1	2	1	145W	Accel. Local Bus	2 Mbyte (VRAM)	1280 x 1024
Professional/GX Standard Resolution	1	2	1	145W	Accel. Local Bus	1 Mbyte (VRAM)	1024 x 768
Professional Workstation	1	2	1	145W	SVGA	1 Mbyte	1024 x 768

11.3 PREMIERE/PCI PENTIUM PROCESSOR BOARD AND SYSTEM FAMILY

The Premiere/PCI baseboard and system family combines lighting-fast system performance with flexibility, future upgradability and high-end graphics performance. The Premiere/PCI Baby-AT provides workstation-class performance in an expandable, industry-standard PC form factor at a significantly better cost/performance ratio than RISC-based engineering workstations. The Premiere/PCI LPX offers the same Intel Pentium processor performance in a standard LPX low-profile form factor. Both boards feature a highly tuned chip set designed to take full advantage of the Pentium processor and 256 Kbytes of writeback cache.

Features

- State-of-the-art 60-MHz Pentium processor technology
- OverDrive processor socket for Pentium processor upgrade
- Built-in PCI Local Bus
- Intel 82434LX controller with 256 Kbytes direct-mapped, writeback cache
- 8-Mbyte memory standard, expandable to 128 Mbytes
- Integrated I/O controller with two serial ports and one parallel port
- Integrated graphics for high and low resolution (Premiere/PCI LPX)

Benefits

- Integrated I/O and graphics for easier integration
- Industry-standard form factors for convenient integration
- State-of-the-art performance today with future upgradability
- Lightning-fast system performance and graphics
- Flexible design for perfectly matching system to application

Applications

- Graphics workstations
- High-performance GUI and Windows applications
- LPX and Baby-AT solutions

Table 11-3a. Premiere/PCI Board and System Specifications

Product Name	Chassis	Bus	Processor/ Speeds	Performance Upgrades	Cache	Memory		Peripheral Bays	Slots			
						Standard	Maximum		Total	PCI Dedicated	ISA Dedicated	PCI / ISA Shared
PCI Baby-AT	Expandable desktop	PCI	Pentium™ processor, 60 MHz	OverDrive™ processor for Pentium microprocessor, 60 MHz	256 Kbyte optional	8 Mbyte	128 Mbyte	4	7	2	4	1
PCI LPX	Low-profile	PCI	Pentium processor, 60 MHz	OverDrive processor for Pentium microprocessor, 60 MHz	256 Kbyte optional	8 Mbyte	128 Mbyte	4	5	2	3	0

Table 11-3b. Premiere/PCI Board and System Specifications (Contd.)

Product Name	Mouse	Serial	Parallel	Power Supply	Video	Standard Video Memory	Maximum Resolution	Other
PCI Baby-AT	1	2	1	200W	None	None	None	FCC Class B, DOC Class B, VDE class B, CISPR-B
PCI LPX	1	2	1	145W	VGA	1 Mbyte (VRAM)	1280 X 1024	FCC CLASS B, DOC CLASS B, VDE CLASS B, CISPR-B

11.4 XPRESS SERVER PLATFORM FAMILY

The Intel Xpress product line offers a complete range of high-performance desktop, deskside and rackmount platforms ranging from the 25-MHz Intel486 SX CPU to the Intel Pentium processor. Their scalable architecture allows Xpress platforms to provide exceptional performance today while providing a continuous path to tomorrow's processor technology. Xpress platforms are based on modular building blocks; combine the modules and four chassis into many different price/performance points, then plug in new microprocessors as they become available. Xpress also offers plenty of slots, watts and bays for expansion in a design that is geared to fast integration, easy service and headroom for future expansion.

Features

- Modular, scalable architecture with support for the Pentium processor
- High-performance EVGA graphics with hardware windows acceleration
- Integrated baseboard with DMA IDE, 2 serial, 1 parallel, keyboard and mouse controller
- Easy-to-integrate/service chassis design
- 384-Mbyte memory capacity
- Flash BIOS
- 3.5″ 1.44-Mbyte floppy drive

Benefits

- Plenty of power for today, easy to add new microprocessors tomorrow
- Super-fast, crisp graphics for high productivity
- Ample slots and watts available for OEM customization

Applications

- Entry-level, mainstream and premium servers
- High-performance, expandable GUI desktop applications
- Embedded applications requiring maximum flexibility

Table 11-4a. Xpress Family Specifications

Product Name	Chassis	Bus	Processor/ Speeds	Performance Upgrades	Cache
Xpress Desktop	Expandable Desktop	EISA	Intel486™ SX/25, DX/33, DX/50, DX2/66, Pentium™ processor modules	Architecture allows use of any Xpress CPU module	128 Kbytes optional on SX/25 and DX/33; 128 Kbytes included on DX2/66 module; 256 Kbytes included on DX/50
Xpress Deskside/LX	Deskside Mid-Tower (20″)	EISA			
Xpress Deskside/MX	Deskside Mid-Tower (24″)	EISA			

Table 11-4b. Xpress Family Specifications (Contd.)

Product Name	Memory		Peripheral Bays	Slots	
	Standard	Maximum		Total	EISA
Xpress Desktop	4 Mbyte/ 16 Mbyte	384 Mbyte	4	6	6
Xpress Deskside/LX	8 Mbyte/ 16 Mbyte	384 Mbyte	8	8	8
Xpress Deskside/MX	8 Mbyte/ 16 Mbyte	384 Mbyte	11	8	8

Table 11-4c. Xpress Family Specifications (Contd.)

Product Name	Ports			Power Supply	Video	Standard Video Memory	Maximum Resolution	Integrated on Baseboard	
	Mouse	Serial	Parallel					IDE	SCSI
Xpress Desktop	1	2	1	215W	SVGA	512 Kbyte	1024 x 768	Yes	Optional
Xpress Deskside/LX	1	2	1	230W	SVGA	512 Kbyte	1024 x 768	Yes	Optional
Xpress Deskside/MX	1	2	1	384W	SVGA	512 Kbyte	1024 x 768	Yes	Optional

11.5 INDUSTRIAL PLATFORMS

Intel's rackmountable microcomputers are used in industrial, communications and office automation applications. They offer a combination of the very best features of several system architectures. Easy integration and maintenance are key features of these rugged rackmountable microcomputers. They also provide the flexibility, expandability and upgradability required by these markets. Multiple fans and filters provide proper cooling for reliable operation in harsh environments where ordinary PCs can fail.

Features

- Supports Xpress and Baby-AT architectures and Intel486 CPUs through Pentium processors
- U.S. and international EMI/RFI and safety certifications
- High-output 230W, 300W or 396W power supply
- Filtered high-performance cooling
- Up to eight EISA/ISA expansion slots
- Optional card hold-down bracket

Benefits

- Wide variety of performance and price points to fit different applications
- Takes the legal worry out of supplying complete system solutions
- Reliable operation in harsh environments
- Easy and economical to maintain and integrate
- Positive pressure in the drive bays prevents airborne contaminants from entering drives and increases up-time

Applications

- Any application operating in extreme temperatures or harsh environments
- Industrial or shop floor applications
- Office automation
- Wiring closets and other communication applications

Table 11-5a. Industrial Platform Specifications

Product Name	Chassis	Bus	Processor/ Speeds	Performance Upgrades	Intel486™ CPU	Pentium™ Architecture	Cache
XpressRACK	Rack	EISA	Intel486 SX/25, Pentium processors	Architecture allows use of any Xpress CPU module			0–256 Kbyte
OmniRACK Classic E	Rack	ISA	Intel486 SX/25, DX/33 processors	OverDrive™ processor	33 MHz	No	64–256 Kbyte
OmniRACK Xpress/RX	Rack	EISA	Intel486 SX/25, Pentium processors	Architecture allows use of any Xpress CPU module			0–256 Kbyte

Table 11-5b. Industrial Platform Specifications (Contd.)

Product Name	Memory		Peripheral Bays	Slots				
	Standard	Maximum		Total	VL-Bus	EISA	ISA 16-bit	ISA 8-bit
XpressRACK	4 Mbyte/ 8 Mbyte	384 Mbyte	4	6 or 8	None	6 or 8	None	None
OmniRACK Classic E	4 Mbyte	64 Mbyte	4	7	1	None	7	None
OmniRACK Xpress/RX	4 Mbyte/ 8 Mbyte	128 Mbyte	4	6 or 8	None	6 or 8	None	None

Table 11-5c. Industrial Platform Specifications (Contd.)

Product Name	Ports			Power Supply	Video	Standard Video Memory	Maximum Resolution	Integrated on Baseboard	
	Mouse	Serial	Parallel					IDE	SCSI
XpressRACK	1	2	1	300W/ 396W	SVGA	512 Kbyte	1024 x 768	Yes	Optional
OmniRACK Classic E	None	2	1	230W	None	None	None	No	None
OmniRACK Xpress/RX	1	2	1	230W	VGA	512 Kbyte	1024 x 768	Yes	Optional

12

PC and LAN Products

CHAPTER 12
PC AND LAN PRODUCTS

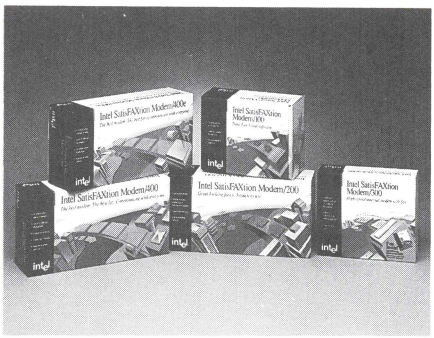
Personal computers and networks are the heart of most business operations—as well as a vital factor in individual productivity. That's why Intel does more than build industry-standard microprocessors. It provides dozens of products that extend the capabilities of the PC—by upgrading its performance, or adding additional functionality like video and faxing. Intel offers networking products that connect PCs to LANs and make networks simpler to use and manage.

12.1 COMMUNICATIONS

12.1.1 SatisFAXtion® Modems

Intel SatisFAXtion® modems give you industry-leading fax and modem technology that makes it easy to exchange information by modem, fax or access on-line information services.

Because there's no such thing as an average fax or modem user, Intel offers a whole line of SatisFAXtion modems with a range of speeds and capabilities. Most include advanced features to ensure that you get the most out of your modem.



Features and Benefits

- V.42bis data compression—enables the actual throughput of the modems to be many times their listed speed
- Automatic feature negotiation—establishes the highest possible connection (in speed and feature set) between modems
- Automatic speed optimization—continually adjusts data speeds to changing line conditions to ensure the fastest possible data throughput
- Quick connect—cuts in half the average time it takes to make a connection, to as little as six seconds
- Adaptive handshake—samples the phone line for noise to make the best line connection

Table 12-1. Intel SatisFAXtion® Modem Overview

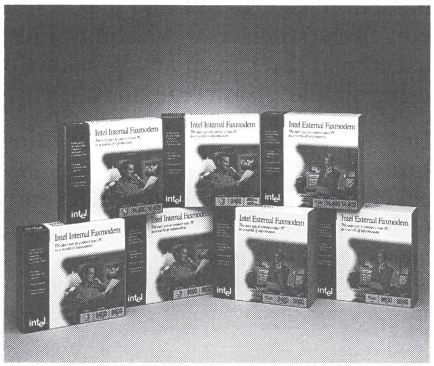
Intel SatisFAXtion® Modem	Data/Fax Speed	Designed for		Share One Line for Data, Fax and Voice	Coprocessed Faxing	Smart UART Buffering	Product Code
		Weekly Fax Use	Weekly Modem Use				
100	2400/9600+	3x	3x	No	No	No	PCFM 6301
200	2400/9600	7-10x	3x	Yes	Yes	Yes	PCFM 6201
400e**	14,400/9600	7-10x	7-10x	No	No	No	PCFM 6501
400	14,400/14,400	10x	7-10x	Yes	Yes	Yes	PCFM 6401

NOTE:
** Indicates external fax modem; all others are internal
+ 9600 send/4800 receive

12.1.2 Intel Faxmodems (Internal/External)

There's no easier or more economical way to plug into the information age than with an Intel Faxmodem. Connect to the expanding universe of bulletin boards and on-line services. And send a fax without ever standing in line at the fax machine.

Intel Faxmodems connect you to an audience of millions. They provide outstanding value, too. They come with an affordably low price tag, plus more than $100 (U.S.) worth of free on-line services.



Features and Benefits

- Seven Intel Faxmodems to choose from – the maximum-speed 14,400 bps faxmodems, the high-speed 9,600 bps faxmodems, or the standard-speed 2,400 bps modems
- Economical, high quality
- Easy, reliable connection to on-line services, electronic bulletin boards, fax machines, faxmodems and remote computers
- V.42bis data compression for up to 4x increase in data throughput+
- Easy installation and setup with installation assistance software

Table 12-2. Intel Faxmodem Overview

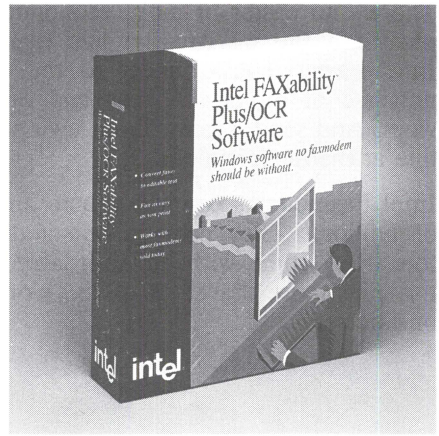
SatisFAXtion® Modem	Data/Fax Speed	Type	Designed for		Best Modems for Large Files/Long Distance	V.42bis Data Compression	Product Code
			Typical Weekly Fax Use	Typical Weekly Modem Use			
24/96i	2400/9600+	Internal	3-7x	3x		No	PCFM 7000
24v/96i	2400/9600	Internal	3-7x	3-7x		Yes	PCFM 7100
24v/96e	2400/9600	External	3-7x	3-7x		Yes	PCFM 7200
96/96i	9600/9600	Internal	3-7x	7-10x	✓	Yes	PCFM 7300
96/96e	9600/9600	External	3-7x	7-10x	✓	Yes	PCFM 7400
144/144i	14,400/14,400	Internal	10x	10x	✓	Yes	PCFM 7500
144/144e	14,400/14,400	External	10x	10x	✓	Yes	PCFM 7600

NOTE:
+ Fax send = 9600; Fax receive = 4800

12.1.3 Intel FAXability Plus/OCR Software

Voted *PC World's* "Best Buy" for fax software, Intel FAXability Plus/OCR software make fax-modems easier to use and makes it a breeze to edit faxes received. FAXability Plus/OCR lets users send faxes from any Windows application using simple print commands.

Instead of just viewing or printing received faxes, turn them into usable files. Special optical character recognition (OCR) software from Calera converts fax images into over 40 text application formats.



Features and Benefits

- QuickFax button for writing quick notes and faxing them instantly
- Instant response feature—just write note over a received fax and click on "Send Fax"
- Drag-and-drop feature for easily faxing of files
- Remote fax retrieval for staying in touch on the road
- FAXability folders for faster access to faxes, sent or received, organized storage and compression

Faxmodems Supported

- Intel SatisFAXtion modems
- Intel faxmodems
- Cardinal
- GVC
- Hayes
- Infotel
- PC logic
- Practical peripherals
- Supra
- Twincom
- Robotics
- Viva
- Zoom

Table 12-3. FAXability Software

Product Name	Product Code
FAXability Plus/OCR software	SWFM6610

12.2 MOBILE COMPUTING ENHANCEMENTS

12.2.1 Intel Faxmodems for PCMCIA

Intel Faxmodems for PCMCIA let users take their offices with them wherever they go. They're credit-card-sized adapters that insert into a mobile computer's PCMCIA slot. Connect them to a phone line to communicate with bulletin boards, email servers, and fax machines everywhere.

Features and Benefits

- Three models to choose from: 14,400 bps data and fax; 9,600 bps data and fax; and 2,400 bps data and fax
- Fast install: Intel Card Manager software for DOS and Windows lets you pop cards in and out without powering down computer
- Fax and data software launch automatically under Windows when card is inserted
- Sleep mode and "resume on ring" capabilities help extend mobile computer's battery life
- V.42, V.42bis for top-speed, error-free data transfers
- Supports PCMCIA Type 2 and 3 slots
- Three-year warranty and on-line registration

Table 12-4. Intel Faxmodem for PCMCIA Overview

Intel Faxmodem	PCMCIA Type 2 & 3 Compatible	Modem Compatibility	Data Throughput	Fax Compatibility	Hayes AT Compatible	Product Code
14.4/14.4	Yes	Up to 14,400 bps, CCITT V.32bis, V.32 V.22bis, V.22, V.21 Bell 212A, Bell 103*	Up to 57,600 bps with V.42/ V.42bis, MNP 2-5, MNP 10	14,400 bps send receive, CCITT Group 3 (V.17, V.29, V.27ter, V.21): Class 1 and 2	Yes**	MBFM 6830
96/96	Yes	Up to 9600 bps, CCITT V.32, V.22bis, V.22, V.21 Bell 212A, Bell 103	Up to 38,400 bps with V.42/ V.42bis, MNP 2-5	9600bps send/ receive, CCITT Group 3 (V.29, V.27ter, V.21): Class 1 and 2	Yes	MBFM 6820
24/96	Yes	Up to 2400 bps, CCITT V.22bis, V.22, V.21, Bell 212A, Bell 103	Up to 9600 bps with V.42/ V.42bis, MNP 1-5	9600 bps send/receive, CCITT Group 3 (V.29, V.27ter, V.21): Class 1	Yes	MBFM 6810

NOTE:

* Includes MNP-10 support for enhanced cellular operations. Cellular use requires purchase of a cellular adapter from cellular phone vendor or a third party.

** Includes Hayes AutoSync support - software not provided, may be purchased separately.

All Intel PCMCIA Faxmodems are also FCC Class B (home and office use), Part 68, DOC certified, and UL and CSA certified.

12.2.2 Intel Wireless Modem

Now send and receive email anytime, practically anywhere in the U.S. The Intel Wireless Modem frees users to communicate even when there's no phone connection. They can exchange email with people on their office LAN or on public email networks like AT&T Mail. Instead of being out of touch for hours at a time, users can be ready in an instant to send and receive email.

Features and Benefits

- Easy to set up—comes with everything needed for sending and receiving wireless email messages
- Easy to learn—works with existing email software so there's no new software to learn
- Convenient when traveling—transparent roaming lets users send messages automatically when outside their home city—without extra codes, extra phone calls, or extra charges
- Simple to use—two buttons to learn: on/off and power mode
- Easy to carry—weighs just a pound, compact enough to share a briefcase with most portable computers
- Sends and receives messages over the RAM Mobile Data Wireless Network, which covers 6,300 cities and towns, including major airports and transportation corridors—90% of the U.S. urban business population

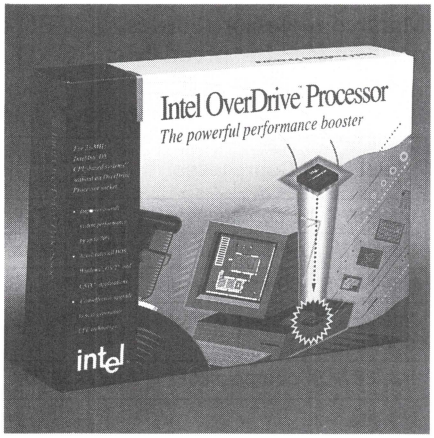
Table 12-5. Intel Wireless Modems

Target System	Lotus cc:Mail*	Microsoft Mail	AT&T Mail
For mobile computers			
Mobile computer email software	cc:Mail Remote v 3.4 or higher (not included)	MS Mail v 3.2 for Windows* Remote or higher (not included)	AT&T Mail Access PLUS for Windows V2.5 or higher (included)
Intel Wireless Modem required	MBWP1000L	MBWP1000M	MWBP1000A
For servers			
LAN server email software	cc:Mail Router v 4.0 or higher (not included)	MS Mail Server v 3.2 or higher (not included)	N/A
Intel Wireless Modem—Server required	MBWP1000S	MBWP1000S	N/A

*Other brands and names are the property of their respective owners.

12.3 PERFORMANCE UPGRADE COMPONENTS

12.3.1 OverDrive™ Processors



Upgradability is an important capability for PC users as today's hardware and software technology continue to demand higher PC performance.

Intel makes upgrading easy and affordable through Intel486 DX2 OverDrive processors, a new family of single-chip processor upgrades that deliver DX2 performance to Intel486 DX and SX CPU-based systems.

By tapping into the next generation of microprocessor technology, Intel OverDrive processors speed up all your software applications by 40% to 70%—including business graphics, spreadsheets, CAD, desktop publishing, databases, and more.

Intel will continue to offer OverDrive processors for all future generations of Intel microprocessors, starting with the forthcoming Pentium™ OverDrive™ processor.

Table 12-6. Intel OverDrive™ Processor Overview

OverDrive™ Processor (Product Code)	Designed for System CPU	OverDrive Processor/ Intel487™ SX Coprocessor Socket in System	Package/Pinout
ODP486SX20	Intel486™ SX-16 CPU	Yes*	169-pin PGA, Intel487 SX coprocessor pinout
ODP486SX20	Intel486 SX-20 CPU	Yes*	169-pin PGA, Intel487 SX coprocessor pinout
ODP486SX25	Intel486 SX-25 CPU	Yes*	169-pin PGA, Intel487 SX coprocessor pinout
ODP486SX33	Intel486 SX-33 CPU	Yes*	169-pin PGA, Intel487 SX coprocessor pinout
ODPR486DX25	Intel486 DX-25 CPU	No	168-pin PGA, Intel486 DX coprocessor pinout
ODPR486DX33	Intel486 DX-33 CPU	No	168-pin PGA, Intel486 DX coprocessor pinout
ODP486DX33	Intel486 DX-33 CPU	Yes	169-pin PGA, Intel487 SX coprocessor pinout

NOTE:
* If your Intel486 SX CPU-based system lacks an OverDrive processor/Intel486 SX CPU socket, it may still support the OverDrive processor. Please check with your PC manufacturer regarding compatibility.

12.3.2 Intel Math Coprocessors

Whether on the road, in the office or at home, an Intel math coprocessor is the most affordable way to accelerate math-intensive applications running on 80286 or Intel386 CPU-based desktop and notebook PCs. Simply plug it in and speed up over 2,100 software applications such as spreadsheets, CAD/CAE and database programs. The Intel Math coprocessor relieves the CPU of floating-point computations. This results in faster performance of spreadsheets, CAD and more.

Table 12-7. Intel Math Coprocessor Overview

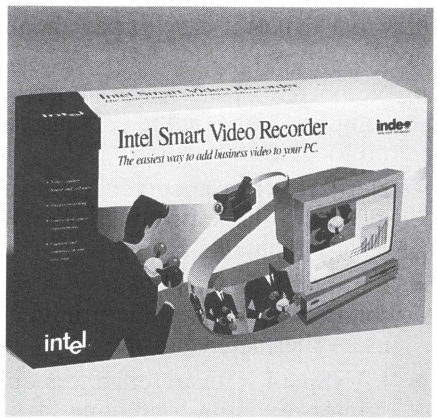
Intel Math Coprocessor	Product Code	Designed for Systems Using this Intel Microprocessor	
Intel287™ XL coprocessor	BOX287XL	80286	All speeds
Intel387™ coprocessor	BOX387SX	Intel386 SX desktop CPU	16-25 MHz
Intel387 SX-33 coprocessor	BOX387SX 33	Intel386 SX desktop CPU	33 MHz
Intel387 SL mobile coprocessor	BOX387SL	Intel386 SX or SL mobile computer CPU	16-25 MHz
Intel387 DX coprocessor	BOX387DX	Intel386 DX CPU	16-33 MHz

12.4 VIDEO

12.4.1 Intel Smart Video Recorder

Bring the power of video to the PC with the Intel Smart Video Recorder. It is the easiest way to add products demonstrations, customer testimonials or video samples to business communications.

Anyone with a 25-MHz Intel486 SX processor-based PC (or higher) can play them back, without any special hardware. The Intel Smart Video Recorder even includes all the necessary software to get users started immediately.



Features and Benefits

- "Plug and shoot"—use input from camcorder, VCR, videodisc player or other analog video sources
- Live monitoring lets users view video images while recording
- Automatically defines and optimizes color palette
- Captures, compresses and stores on disk in one step, dramatically reducing disk space requirements
- Takes one minute to record a one-minute video clip (vs. 15 minutes or more for competition)
- On-board i750® video processor provides the power to capture all the data needed for high-quality playback
- Indeo™ video technology ensures high-quality playback on any Intel486 microprocessor-based PC and automatically maximizes playback quality

Table 12-8. Intel Smart Video Recorder

Physical	Full-length ISA board with one RCA and one S-VHS video input jack
Video types	Accepts NTSC or PAL analog video—composite or Y/C (S-VHS)
Image size and resolution	Records up to 15 frames per second (fps) in a 320 x 240 window (1/4 screen) Records up to 15 frames per second (fps) in a 240 x 180 window Records up to 30 frames per second (television quality) in a 160 x 120 window
Product	**Code**
Intel Smart Video Recorder	PCVD1000

NOTE:
Playback frame rate varies depending on the playback PC

12.5 LAN PRINTING AND FAX SOLUTIONS

12.5.1 LAN Printing

Intel offers a full line of network printing products that makes it easy to add capabilities as a network grows.

- NetportExpress™ XL print server, provides complex, high-volume printing on multi-protocol networks
- NetPort® II print server is designed for medium-volume printing in NetWare* environments
- LanspoolExpress software is a software solution for low-volume printing with a few users sharing each printer
- LANSpool software enhances up to 60 printers and adds outbound faxing

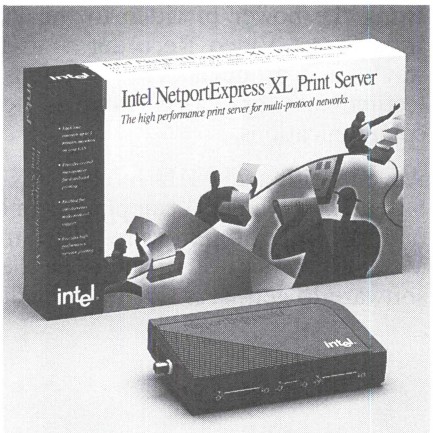


Table 12-9. NetPort® Print Servers Overview

Features	NetportExpress™ XL Print Server	NetPort® II Print Server
Printers supported	All brands and models	All brands and models
Simultaneous printers	3	2
Upgradability	Flash	Flash
Protocols supported	NetWare*, TCP/IP, AppleTalk*, LAN Manager*	NetWare
Performance	180 Kbps	20 Kbps
Bi-directional	Yes	No
Token Ring support	4/16 Mbps on STP 4/16 Mbps on UTP	4/16 Mbps on STP 4 Mbps on UTP with MAU
Remote boot load	Yes	No
Ethernet* media	Thin coax (10Base2)/UTP (10Base-T)	Thin coax (10Base2)/ Thin coax (10Base5)/,UTP (10base-T)
Token Ring media	UTP (Type 3) and STP (Type 1)	STP (Type 1)
Product Codes		
Ethernet	PCLA2131	PCLA 2121 (thick/thin wire) PCLA 2221 (10BASE-T)
Token Ring	PCLA2331	PCLA2321

*Other brands and names are the property of their respective owners.

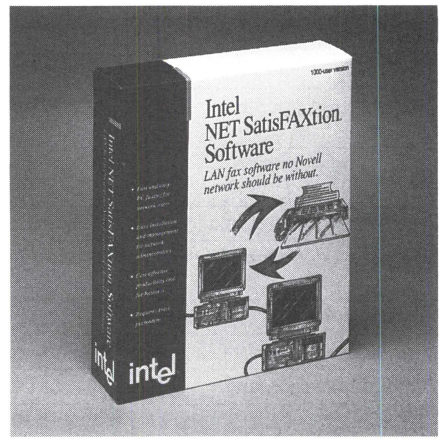
Table 12-10. Intel LANSpool Software Overview

Feature	LanspoolExpress Software, v 1.0	LANSpool Software v 3.5
Performance	Up to 50 Kbps	Up to 28 Kbps
Reliability	More reliable IPX connection	SPX connection
Background operation	RPrinter enhancement: works with PServer/RPrinter	Replaces PServer and RPrinter
Dedicated operation	NetPort® print server emulation with NPAdmin support	Proprietary, utilities work only with LANSpool
Rush print jobs to next in line	Yes (dedicated mode only)	No
Secure queue capability	Protects confidential print jobs (dedicated mode only)	No
Dynamic reattach	Yes	Yes
Printer selection	LANPrint menu - DOS & Windows*	LANPrint menu - DOS & Windows
Queue management	LANQView - DOS	LANQView - DOS
TSR	2 Kbyte loaded high	2.5 Kbyte loaded high
Windows print stations	Yes	Yes
Fax capability	No	Yes
Number of printers	16 per NLM (background mode only)	40 per VAP, 60 per NLM

*Other brands and names are the property of their respective owners.

12.5.2 NET SatisFAXtion Software

Intel NET SatisFAXtion software is centrally managed fax server software that easily integrates fax services into NetWare, LAN Manager*, and LAN Server* networks.



NET SatisFAXtion software turns a networked PC into a dedicated fax server that can send and receive faxes using up to eight Intel SatisFAXtion modems. NET SatisFAXtion software is a productivity booster for any organization. Faxing is as easy as printing, and there's no time wasted at the fax machine. Also, users can schedule long distance faxes to be sent when rates are lowest. NET SatisFAXtion software records departmental fax usage for accounting and bill-back and offers client billing capabilities for service-oriented businesses.

Features and Benefits

- Support for NetWare 2.2x and 3.1x, LAN Manager 2.1 or 2.2, LAN Server 2.0 or 3.0
- Supports up to 20 or 1,000 users per fax server
- Automatic user configuration
- Phonebook database importing (ASCII, CSV)
- Users can send faxes from within any DOS or Windows application as easily as printing
- Central management and control of all NET SatisFAXtion servers
- DTMF (touch-tone) automatic inbound routing
- Built-in support for third-party Direct Inward Dial (DID) automatic inbound routing
- Automatic printing option for incoming faxes
- HP LaserJet* III (PCL5) and Epson (FX-85) emulation
- Supports HP font cartridges A through Z, except F and Bar Codes

Table 12-11. NET SatisFAXtion® Software

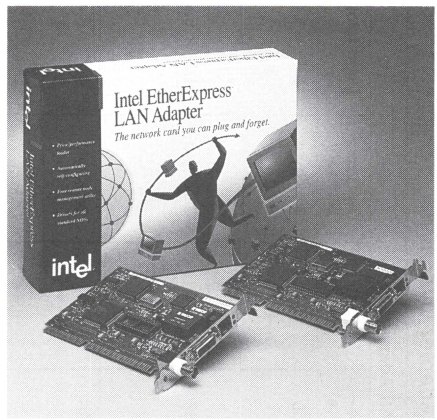
Number of Users	Product Code
1000-user version	SWLF6700
20-user version	SWLF6720
20 to 1000-user license upgrade	SWLF6721

12.6 NETWORK ADAPTERS

12.6.1 EtherExpress™ LAN Adapters

Intel EtherExpress™ LAN adapters are fast, affordable and full of features to make networks easier to build and manage.

Intel semiconductor technology lowers the chip count and improves performance and reliability. Also, Intel Ethernet networking products are compatible with the IEEE 802.3 standard and a broad range of network operating systems and hardware, so they'll fit – and work – just about anywhere you put them. Finally, Intel products are so easy to use that network managers can literally "plug and forget" them.



Features and Benefits

- Automatic software configuration means adapters practically install themselves – no jumpers or switches to set, no need to master IRQs, I/O addresses or bus-timing parameters
- Provides a wealth of management information to make network management easier
- Optional Intel SNMP Services software makes it easy for Novell NetWare 3.X users to manage their network from a central SNMP console
- Includes Intel flash memory onboard for convenience and manageability by automating configuration, driver loading and asset management
- Supports the most popular network operating systems

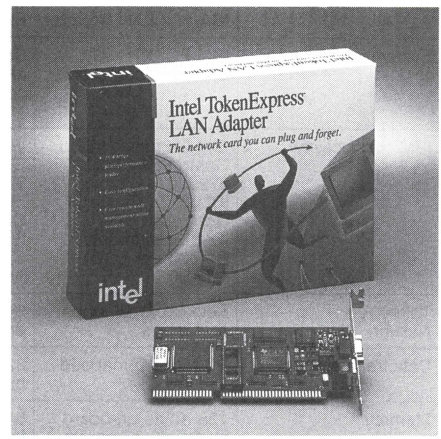
Table 12-12. EtherExpress™ LAN Adapter Overview

EtherExpress™ LAN Adapters									
Adapter	**Bus**	**Media Connection**	**System Compatibility**	**Ethernet Standard**	**Ethernet Controller(s)**	**Flash Memory**	**On-Board Memory**	**Dimensions**	**Product Code**
EE16	ISA	BNC, AUI	IBM PC/XT*, AT, EISA, & compatibles IBM PS/2* Models 25,30	IEEE 802.3	Intel 82586	N/A	32 Kbyte	4.2″ × 6.4″	PCLA 8100
EE16 TP	ISA	RJ45, AUI	IBM PC/XT, AT, EISA, & compatibles IBM PS/2 Models 25, 30	IEEE 802.3	Intel 82586	N/A	32 Kbyte	4.2″ × 6.4″	PCLA 8120
EE 16C	ISA	RJ45, BNC, AUI	IBM PC/XT, AT, EISA, & compatibles IBM PS/2 Models 25, 30	IEEE 802.3	Intel 82586	256 Kbyte socket	32 Kbyte	4.2″ × 6.4″	PCLA 8100
EE FlashC	ISA	RJ45, BNC, AUI	IBM PC/XT, AT, EISA, & compatibles IBM PS/2 Models 25, 30	IEEE 802.3	Intel 82586	256 Kbyte onboard	32 Kbyte	4.2″ × 6.4″	PCLA 8105
EE MCA	MCA	BNC, AUI	IBM PS/2 models 50 thru 95 & compatibles	IEEE 802.3	Intel 82586	256 Kbyte onboard	64 Kbyte	3.5″ × 6.5″	MCLA 8110
EE MCA TP	MCA	RJ45, AUI	IBM PS/2 models 50 thru 95 & compatibles	IEEE 802.3	Intel 82586	256 Kbyte onboard	64 Kbyte	3.5″ × 6.5″	MCLA 8120
EE 32	EISA	BNC, AUI	EISA-bus computers	IEEE 802.3	Intel 82586 Bus Master Interface; Intel 82355	N/A	48 Kbyte	Standard EISA	EILA 8125

*Other brands and names are the property of their respective owners.

12.6.2 TokenExpress™ LAN Adapters

Intel TokenExpress™ LAN adapters are fast, affordable and full of features that make token ring networks simpler to build and manage. They're interoperable with the entire IBM hardware and software environment. They also include highly optimized device drivers, selective protocol processing, and on-board memory to provide unmatched performance.



Features and Benefits

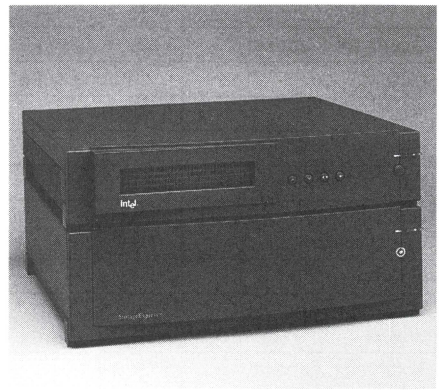
- Easy installation—the ISA/16s board utilizes Intel's exclusive TokenSet software to automatically configure interrupts, I/O addresses, and the DMA channel. The EISA and MCA boards utilize the standard switchless configuration inherent in these architectures.
- Includes a 9-pin connector for shielded twisted pair (STP) media, as well as a built-in media filter and RJ-45 connector for easy connection to unshielded twisted pair (UTP)
- 128 Kbyte (512K on EISA/32) of on-board memory provides ample room for transmit and receive buffers
- Bus master capability allows direct read/write communications with system memory
- Includes drivers to support NetWare, LAN Server, LAN Manager and OS/2

Table 12-13. TokenExpress™ LAN Adapter Overview

Feature	TokenExpress™ ISA/16s LAN Adapter	TokenExpress EISA/32 LAN Adapter	TokenExpress EISA LAN Adapter	TokenExpress MCA LAN Adapter
System compatibility	IBM PC, XT*, AT*, EISA and compatible	Compaq* SystemPro and 100% EISA compatibles	Compaq SystemPro and EISA-bus computers	IBM PS/2* computers and other compatibles w/Micro Channel* architecture
IBM connectivity	IBM Communication Controllers: 3720, 3725, 3745 IBM 3174 Cluster Controller IBM Departmental Computers: 9370, AS/400	IBM Communication Controllers: 3720, 3725, 3745 IBM 3174 Cluster Controller IBM Departmental Computers: 9370, AS/400	IBM Communication Controllers: 3720, 3725, 3745 IBM 3174 Cluster Controller IBM Departmental Computers: 9370, AS/400	IBM Communication Controllers: 3720, 3725, 3745 IBM 3174 Cluster Controller IBM Departmental Computers: 9370, AS/400
Token Ring Network data rates	Selectable 16 Mbps or 4 Mbps	Selectable 16 Mbps or 4 Mbps	Selectable 16 Mbps or 4 Mbps	Selectable 16 Mbps or 4 Mbps
Data transfer mode	DMA or I/O mapped	32-bit EISA DMA burst mode	EISA bus master DMA	Micro Channel Bus Master burst mode
Memory	128 Kbyte on-board for transmit, receive buffers and download of protocols	512 Kbyte on-board for transmit, receive buffers and download of protocols	128 Kbyte on-board for transmit, receive buffers and download of protocols	128 Kbyte on-board for transmit, receive buffers and download of protocols
RPL socket	Flash-capable 256 Kbyte socket	128 Kbyte socket	128 Kbyte socket	128 Kbyte socket
Connectors	9-pin "D" subminiature for STP media RJ-45 for UTP media	9-pin "D" subminiature for STP media RJ-45 for UTP media	9-pin "D" subminiature for STP media RJ-45 for UTP media	9-pin "D" subminiature for STP media RJ-45 for UTP media
Dimensions	Half-size card, 156 mm x 78 mm (6.1 in. x 3.1 in.)	240 mm x 100 mm (9.5 in. x 3.9 in.)	half-size card, 188 mm x 112 mm (7.4 in. x 4.4 in.)	292 mm x 88mm (11.5 in. x 3.5 in.)
Product Code	PCLA 8130A	EILA8245	EILA8235	MCLA8330

12.7 NETWORK BACKUP: INTEL StorageExpress™ SYSTEM

The Intel StorageExpress™ system combines both hardware and software into a totally integrated, centrally managed backup system for multi-server NetWare networks. The system provides automated backup and restoration of data on all file servers and workstations on the network.



StorageExpress systems automate what has until now been a fragmented, time-consuming task for network administrators: backing up and restoring network data on servers and workstations. The StorageExpress system uses NetWare Runtime as its core operating system. It is compliant with Novell's Storage Management Services (SMS), allowing the system to back up all files, including the bindery, trustee rights, and name spaces, on NetWare file servers.

Several configurations of the StorageExpress system are available to suit the needs of a wide range of network installations.

Features and Benefits

- Attaches directly to the network rather than to file servers, allowing installation in as little as 20 minutes without downing file servers or disrupting network operation
- Allows point-and-click tailoring of backup sessions and restore operations
- Automates many of the tedious aspects of network backup to minimize chance of human error
- Allows choice of custom rotation scheme or pre-defined grandfather-father-son scheme
- Engineered for reliable unattended operation so backup sessions can run overnight and on weekends, without the LAN administrator being present
- Provides standard NetWare server-level security as well as encrypted password protection in the central console software

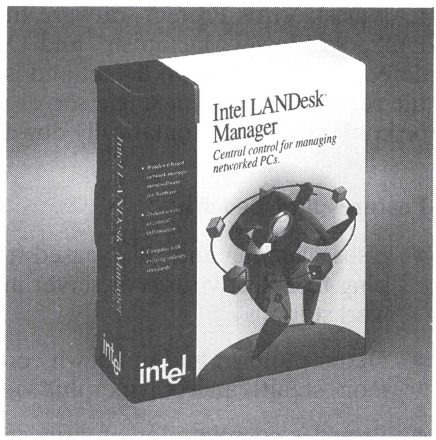
Table 12-14. Intel StorageExpress™ Systems Overview

Feature	System ELD	System XLD	System XLE
Microprocessor	Intel486™ SX 25-MHz CPU	Intel486 DX 33-MHz CPU	Intel486 DX 33-MHz CPU
OverDrive™ socket	Yes	Yes	Yes
LCD/keypad	4 x 40 character	4 x 40 character	4 x 40 character
Memory	8 Mbyte	8 Mbyte	8 Mbyte
Hard disk drive	200 Mbyte	500 Mbyte	500 Mbyte
Tape drives: standard	2 Gbyte DAT	2 Gbyte DAT	5 Gbyte 8 mm EX8500C
Capacity with compression	4 Gbyte	4 Gbyte	10 Gbyte
Upgrade option	2 Gbyte DAT	2 Gbyte DAT	5 Gbyte 8 mm EX8500C
Max. number of tape drives	2	4	4
Total max. capacity with compression	8 Gbyte	16 Gbyte	40 Gbyte
Product Codes	SMS0310	SMS0410	SMS0610

NOTE:
All models include 32-bit SCSI and 32-bit Ethernet integrated on the motherboard. All models also include an optional 4/16 Token Ring adapter and a preconfigured serial port.

12.8 NETWORK MANAGEMENT

12.8.1 Intel LANDesk™ Manager v1.5



Intel LANDesk™ Manager lets network administrators centrally manage everything on the network – from desktops, to servers, to segments and services. It includes tools for server application monitoring, network activity monitoring, hardware and software inventory, virus scanning and removal, and remote control.

The LANDesk Manager control panel becomes a single-point source of information and control for network activities. Real-time graphic displays provide up-to-the-second information that helps administrators pinpoint, analyze and solve problems proactively.

LANDesk Manager provides a full complement of tracking and control capabilities. Monitor network activity and fine-tune LAN performance, detect and remove viruses, or get a complete summary of the hardware and software resources on any PC LAN – from the LANDesk Manager control panel.

Features and Benefits

- Windows-based control panel allows jumping from one LANDesk Manager tool to another and makes analysis easy
- Real-time summary of hardware and software resources on the LAN
- Real-time summary of application usage
- Network Printer Manager for easy printer access and monitoring
- "Quick Windows" for faster viewing of user workstations running Windows
- Server Monitor enhancement tracks 17 server parameters
- Inventory Manager support for servers and Mac* workstations

Table 12-15. LANDesk™ Manager

Product	Product Code
LANDesk™ Manager	SLAN1300

12.8.2 Intel LANDesk Virus Protect v2.0

The best virus protection is total virus protection. NetWare-certified Intel LANDesk Virus Protect software provides total virus protection — not just down to the node, but down to the portable PC that comes and goes.

LANDesk Virus Protect software fills the virus security gaps. It transparently monitors DOS, Windows, Macintosh* and OS/2 network traffic. It uses the most sophisticated detection technology to detect and isolate known and unknown viruses. It lets you group file servers and copy a single server setup to them all. And LANDesk Virus Protect can be configured to automatically download new virus patterns from the Intel BBS.

Features and Benefits

- Uses scanning and rules-based trapping to detect viruses at server and workstations
- Detects known and unknown common, stealth and polymorphic viruses
- Provides complete log of virus activity across domains
- Domain configuration lets you configure any number of servers from a single server setup
- Integrated with Intel LANDesk Manager
- Transparently monitors DOS, Windows, Macintosh and OS/2 files at the server
- Simple workstation installation

Table 12-16. LANDesk™ Virus Protect

Product	Product Code
LANDesk™ Virus Protect	SLAN 1218

12.8.3 Intel LANDesk Response

To make life easier for the help desk staff, LANDesk Response is a powerful, affordable problem tracking system. Its intuitive approach and Windows interface make it simple to log calls, organize trouble tickets, look up previous problems and decide what to do next. All of which is bound to mean better service for your customers and less stress for support staff.

LANDesk Response is flexible, so problems can be organized hierarchically by problem type, product, customer, department. Sophisticated filtering, search and query capabilities help users hone in on specific problems quickly. Users can reference tickets based on a wide range of criteria, even text strings describing a problem or solution.

There's also a full set of customizable reports and charts for analyzing everything from workloads and help response times to product performance and productivity.

Features and Benefits

- Easy to enter trouble tickets, easy to organize information
- Tickets can be organized hierarchically by product, problem type, customer, department
- Response card tracks status of problem-solving activities
- Windows-based user interface, user-definable terminology and complete on-line help increase user acceptance and productivity
- Flexible formatting and user-defined ticket filters available for producing customizable reports and charts
- Privilege levels with passwords prevent unauthorized access
- Compatible with Intel LANDesk Manager

Table 12-17. LANDesk™ Response

Product	Product Code
LANDesk™ Response	SLAN1350

12.8.4 LANDesk SNMP Gateway v1.5

LANDesk SNMP Gateway lets network managers supervise individual workstations from their console. The software links network management consoles to desktop PCs and other devices on the LAN through the industry-standard Simple Network Management Protocol (SNMP). Network managers can manage any device or workstation running on Novell NetWare 3.11 LANs—without additional overhead at individual workstations.

Features and Benefits

- Lets you manage LAN workstations below the adapter level
- Provides the ability to gather statistics on up to 500 fields, such as the size of the fixed disk, percentage of disk utilization, and workstation software
- Supports host resources MIB for the desktop
- Uses a unique NLM technology to avoid additional overhead on workstations
- Central configuration for all community devices from the file server console

Table 12-18. LANDesk™ SNMP Gateway

Product	Product Code
LANDesk™ SNMP Gateway	SLAN1221

A

Handbook Directory

APPENDIX A
HANDBOOK DIRECTORY

This alphanumeric document index is designed to provide a roadmap to the handbooks and make it easy to find product information. The index lists all the individual documents printed in this year's handbooks. To use the directory simply find the name of the document you are seeking in the alphanumeric index and note the handbook title and the page number.

Application briefs (ABs) and application notes (APs) are listed under their assigned AB or AP numbers, followed by article reprints (ARs). All of these documents will be found under the "A" section of the index; engineering reports (ERs) are listed under their assigned ER numbers.

Handbooks can be ordered individually or as a set; refer to the inside front cover of this publication for a complete listing. Ordering information is located on the pages at the front of this publication.

Alphanumeric Index

Document	Handbook	Page
28F001BX-T/28F001BX-B 1M (128K x 8) CMOS Flash Memory	Flash Memory (Vol. I)	4-179
	Microprocessors (Vol. II)	5-1
28F008SA 8 Mbit (1 Mbit x 8) Flash Memory	Microprocessors (Vol. II)	5-5
28F008SA 8 Mbit (1 Mbit x 8) FlashFile™ Memory	Flash Memory (Vol. I)	3-49
28F008SA-L 8 Mbit (1 Mbit x 8) FlashFile™ Memory	Flash Memory (Vol. I)	3-77
28F010 1024K (128K x 8) CMOS Flash Memory	Flash Memory (Vol. I)	5-33
28F016SA 16 Mbit (1 Mbit x 16, 2 Mbit x 8) FlashFile™ Memory	Flash Memory (Vol. I)	3-6
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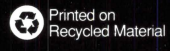
*Carry-in locations

Product Overview

Intel is a leading supplier of microcomputer components, modules and systems. The company focuses on supplying the building blocks for the "new computer industry" – an industry in which many key products are built around the PC architecture standard.

The Product Overview provides a guide to Intel's major product families. However, readers familiar with the Product Overview will find that this year's edition has a new format. Based on customers comments the 1994 Product Overview has been streamlined; it now provides a summary along with a quick reference to the technical specifications for each product family. It also contains the handbook directory, a comprehensive listing of all documents printed in this years handbooks.

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